ROUSH CLEANTECH

2011-2013

Ford E-150/E-250/E-350/E-450 F-250/F-350

Liquid Propane Autogas Fuel System (3rd Generation)

Includes:

E-150/E-250/E-350 Cargo Van/Wagon
E-150/E-250/E-350 Extended Range Cargo Van/Wagon
E-450 Custom Body
F-250/F-350

Revision History		
-AA	Intital Release	2/2013
-AB	Revised	5/2013

DIAGNOSTIC MANUAL
P-01B101-AB

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INTRODUCTION

SAFETY INFORMATION

The National Fire Protection Association (NFPA) publishes a code book of rules that apply to the storage, handling, transportation and use of liquefied petroleum gas (LP-Gas or LPG). The book is known as NFPA 58. It is revised as necessary and published every other year. This code is adopted as law in virtually every political subdivision in the United States. Check with your local authorities for regulations applicable to liquid propane.

Alert Messages

The following alert messages may appear from time to time in appropriate places in this manual. Ensure that all personnel read and adhere to these alert messages.

⚠ DANGER

Although propane is nontoxic, nonpoisonous, has the lowest flammability range of any alternative fuel and dissipates quickly when released into the atmosphere, propane vapor is heavier than air and seeks the lowest point. When the ratio of propane to air is between 2.2% and 9.6%, propane will burn in the presence of an ignition source at 940°F (504°C) or hotter. Keep away from heat, sparks, flames, static electricity or other sources of ignition. Failure to heed this danger may result in severe personal injury or death.

⚠ DANGER

The fuel supply lines remain pressurized after engine shutdown. Keep away from heat, sparks, flames, static electricity or other sources of ignition. Do NOT enter storage areas or confined space unless they are adequately ventilated. Failure to heed this danger may result in severe personal injury or death.

⚠ DANGER

Do NOT carry lighted smoking materials or smoke while working on fuel system components. Failure to heed this danger could result in severe personal injury or death.

⚠ DANGER

Disconnect the battery ground at the battery to ensure that the vehicle electrical system has no current. Failure to heed this danger could result in severe personal injury or death.

⚠ DANGER

Propane is heavier than air and seeks the lowest available level when released to the atmosphere. Keep heat, sparks, flames, static electricity or other sources of ignition out of the area when venting or purging the fuel lines or tank. Failure to heed this danger can result in severe personal injury or property damage.

⚠ DANGER

Technicians working with, or around, fuel systems should be properly trained to utilize extreme care and caution at all times. Failure to exercise extreme caution and care may lead to serious accidents which can result in property damage, personal injury and/or death.

⚠ WARNING

Liquid propane is cold. The temperature of propane in its liquid state at atmospheric pressure is –44°F (–42°C). Wear eye and ear protection during venting and repair operations. Keep moisture away from the valves. Failure to heed this warning can result in personal injury.

Installation, Garaging and Training

Chapter 11 of NFPA 58 applies to engine fuel systems using LP-Gas in internal combustion engines, including containers, container appurtenances, carburetion equipment, piping, hose and fittings and their installation. Additionally, this chapter applies to garaging of vehicles and to the training of personnel.

Paragraph 11.2 specifies that each person engaged in installing, repairing, filling or otherwise servicing an LP-Gas engine fuel system shall be trained. Contact the Propane Education and Research Council to learn more about their CETP E-Learning computer-based training program: courtney.gendron@propanecouncil.org, or vincent.sibilia@propanecouncil.org.

Purging and Venting (Tanks and Lines)

Venting of LP-Gas to the atmosphere is covered by paragraphs 7.3.1, General, and 7.3.2, Purging of NFPA 58, 2008 edition. Refer to NFPA 58, Local Codes and Proper Training for specific information relating to safe venting of LPG.

TROUBLESHOOTING

DIAGNOSTIC TROUBLE CODES

About Diagnostic Trouble Codes

All diagnostic trouble codes (DTCs) known to be affected by the liquid propane autogas (LPA) system are covered in this manual. For all other DTCs, refer to the *Ford Powertrain Control/Emissions Diagnosis Service Manual* at www.motorcraft.com.

System and Diagnostic Terminology

Acronym or Abbreviation	Description
BS	Bleed Solenoid
CAN	Controller Area Network
DTC	Diagnostic Trouble Code
EFPR	Electronic Fuel Pump Relay
ERFS	Electronic Returnless Fuel System
EVAP	Evaporative
FCS	Flow Control Solenoid
FLIM	Fuel Level Interface Module
FLS	Fuel Level Sender
FP	Fuel Pump
FPCM	Fuel Pump Control Module
FRP	Fuel Rail Pressure
FRPCM	Fuel Rail Pressure Control Module
FTS	Fuel Temperature Sensor
GRD	Ground
HEGO	Heated Exhaust Gas Oxygen
IC	Instrument Cluster
IPTS	Integrated Pressure Temperature Sensor
KOEO	Key On Engine Off
KOER	Key On Engine Running
LPA	Liquid Propane Autogas
MAF	Mass Air Flow
OEM	Original Equipment Manufacturer
OPD	Overfill Protection Device
PCM	Powertrain Control Module
PID	Parameter Identification
PWR GND	Power Ground
SIG RTN	Signal Return
SRM	Smart Relay Module

Acronym or Abbreviation	Description
SS	Supply Solenoid
TS	Tank Solenoid
VMV	Vapor Management Valve
VPWR	Voltage Power
VREF	Voltage Reference
WOT	Wide Open Throttle

Diagnostic Trouble Code List

Code	Description
Flow Control Solenoid	
P0090	Fuel Pressure Regulator Circuit Open
Bleed Solenoid	
P009E	Fuel Pressure Relief Control Performance Stuck Off
P009F	Fuel Pressure Relief Control Stuck On
P009B	Fuel Pressure Relief Control Circuit Open
Tank Solenoid	
P0005	Fuel Shutoff Valve A Control Circuit Open
Fuel Rail Pressure Control Module Supply Solenoid and Wiring	
P26B5	Fuel Shutoff Valve B Function Check
P2632	Fuel Pump B Control Circuit Open
P2665	Supply Solenoid Circuit Fault
SRM, CAN Bus Circuit Wiring	
U0108	Lost Communication with Alternative Fuel Control Module
Fuel System	
P0148	Fuel Delivery Error
P116E	Maximum Pressure
P0171, P0174	System Too Lean (Bank 1 and Bank 2)
P03xx	Misfire
U0309	Alt Fuel Module-Wrong SRM
Heated Exhaust Gas Oxygen Sensor	
P2195, P2197	Heated Exhaust Gas Oxygen Sensor Stuck
Electronic Fuel Pump Relay (B)	
U016C	Lost Communication with Fuel Pump Control Module B
P027A	Fuel Pump Control Module Circuit Range/Performance
Integrated Pressure Temperature Sensor	
P0182	Fuel Temperature Sensor (A) Circuit Low
P0183	Fuel Temperature Sensor (A) Circuit High
P0190	Fuel Pressure Sensor A Circuit
P0192	Fuel Pressure Sensor A Circuit Low
P0193	Fuel Pressure Sensor A Circuit High

Fuel Level Sender	
P0460	Fuel Level Sender A Circuit
P0461	Fuel Level Sender A Circuit Range/Performance
P0462	Fuel Level Sender A Circuit Low

Flow Control Solenoid

P0090 — Fuel Pressure Regulator Circuit Open

Description	FCS circuit fault. SRM monitors FCS circuit for open and short circuit faults.
Possible Causes	• Short to voltage • Water in the harness connector • Open power circuit • GND circuit • Low battery voltage • Corrosion • Incorrect connections • Damaged FCS coil • Blown fuse
Symptom	Fuel pressure in the rail does not change when commanded. Extended fuel rail flush time.
Diagnostic Aid	Check the FRPCM and SRM electrical connector for damage, corrosion and water intrusion.
Action	Refer to the *Fuel Rail Pressure Control Module Electrical Check* procedure in *Diagnostic Tests and Procedures*.

Bleed Solenoid

P009E — Fuel Pressure Relief Control Performance Stuck Off

Description	Fuel rail failed to bleed. The PCM measures fuel rail pressure on key-up to determine if fuel rail has been properly bled.
Possible Causes	• BS did not open • FRPCM check valve leaked • FRPCM supply solenoid leaked • Bleed port (bleed rate restrictor in outlet to VMV) clogged • EVAP line kinked • Blown fuse
Symptom	Fuel pressure present in the fuel rail after bleed event should have occurred; this may result in hard starts.
Diagnostic Aid	Check that FRPCM bleeds fuel from rail. Leaks to FRPCM can also trigger a fault.
Action	Refer to the *Fuel System Fails to Bleed* procedure in *Diagnostic Tests and Procedures*.

P009F — Fuel Pressure Relief Control Stuck On

Description	Bleed solenoid stuck open. While the engine is running, the PCM seals the EVAP system and checks for a rise in pressure. If pressure in the EVAP system exceeds the threshold, a fault is set.
Possible Causes	• Short to GRD • Armature stuck in post • Solenoid seal compromised
Symptom	There is a potential for fuel odor.
Diagnostic Aid	—
Action	Refer to the *Fuel Rail Pressure Control Module Electrical Check* procedure in *Diagnostic Tests and Procedures*.

P009B — Fuel Pressure Relief Control Circuit Open

Description	Bleed solenoid circuit fault. The SRM monitors bleed solenoid circuit for open and short circuit faults.
Possible Causes	• Short to voltage • Water in the harness connector • Open power circuit • Open GND circuit • Low battery voltage • Corrosion • Incorrect connections • Damaged BS coil
Symptom	Fuel rail bleed system does not operate correctly. There is a potential for fuel odor or hard start.
Diagnostic Aid	Check the FRPCM and SRM electrical for damage, corrosion and water intrusion.
Action	Refer to the *Fuel Rail Pressure Control Module Electrical Check* procedure in *Diagnostic Tests and Procedures*.

Tank Solenoid

P0005 — Fuel Shutoff Valve A Control Circuit Open

Description	TS circuit fault. The SRM monitors tank solenoid circuit for open and short circuit faults.
Possible Causes	• Short to voltage • Water in the harness connector • Open power circuit • Open GND circuit • Low battery voltage • Corrosion • Incorrect connections • Damaged TS coil • Blown fuse
Symptom	Vehicle does not start. The pumps run but no pressure builds in the fuel rail.
Diagnostic Aid	Check the FRPCM and SRM electrical connectors for damage, corrosion and water intrusion.
Action	Refer to the *Tank Solenoid Electrical Check* procedure in *Diagnostic Tests and Procedures*.

Fuel Rail Pressure Control Module Supply Solenoid and Wiring

P26B5 — Fuel Shutoff Valve B Function Check

Description	Fuel supply solenoid stuck. The SRM monitors fuel rail pressure before and after the solenoid was commanded open. If the pressure rise is below a threshold, the fault is set.
Possible Causes	• Electrical fault • Damaged SS coil • Damaged SS armature • Excess flow valve tripped • Tank solenoid stuck closed • Tank manual valve closed • Fuel pumps not powering on • Blown fuse
Symptom	Vehicle does not start. The pumps run (or may not) but no pressure builds in the fuel rail.
Diagnostic Aid	Check the FRPCM and SRM electrical connectors for damage, corrosion and water intrusion.
Action	Refer to the *Engine Cranks, No Start* procedure in *Diagnostic Tests and Procedures*.

P2665 — Supply Solenoid Circuit Fault

Description	FRPCM supply solenoid circuit fault. SRM monitors supply solenoid circuit for open and short circuit faults.
Possible Causes	• Short to voltage • Water in the harness connector • Open power circuit • Open GND circuit • Low battery voltage • Corrosion • Incorrect connections • Damaged SS coil • Blown fuse
Symptom	Vehicle does not start. The pumps run but no pressure builds in the fuel rail.
Diagnostic Aid	Check the FRPCM and SRM electrical connectors for damage, corrosion and water intrusion.
Action	Refer to the *Fuel Rail Pressure Control Module Electrical Check* procedure in *Diagnostic Tests and Procedures.*

SRM, CAN Bus Circuit Wiring

U0108 — Lost Communication with Alternative Fuel Control Module

Description	Lost communication with SRM. The PCM monitors CAN bus communication for missing messages from the SRM. If the messages are continuously missing, a fault is set.
Possible Causes	• Wiring between the SRM and PCM • SRM lacks power • Blown fuse
Symptom	Rough idle.
Diagnostic Aid	Check the FRPCM and SRM electrical connectors for damage, corrosion and water intrusion. Check for power at the SRM.
Action	Refer to the *Smart Relay Module Electrical Check* procedure in *Diagnostic Tests and Procedures*.

Fuel System

P0148 — Fuel Delivery Error

Description	LPA system is operating in vapor space. At least one bank is lean at WOT.
Possible Causes	• Severely restricted fuel filter • Severely restricted fuel supply line • Damaged or worn fuel pump • Damaged or contaminated MAF sensor • Excess flow valve tripped • TS or SS closed • Tank manual shutoff valve not completely open
Symptom	Vehicle hesitation or stall condition.
Diagnostic Aid	—
Action	Refer to the *Engine Cranks, No Start* procedure in *Diagnostic Tests and Procedures*.

P116E — Maximum Pressure

Description	Maximum injection pressure reached. The PCM monitors fuel rail pressure and battery voltage. Based on these measurements, the PCM adjusts fuel pump speed to stay below the maximum operating pressure of the injectors.
Possible Causes	• Operating the vehicle in high ambient conditions • Vehicle operated in a low voltage condition
Symptom	Vehicle hesitation, stall, rough idle, misfire or no start.
Diagnostic Aid	The P116E code is meant as an indication that the fuel system was operated at the limits of the system. The customer may have experienced drive issues although the system is performing as expected.
Action	Refer to the *Maximum Pressure Check* procedure in *Diagnostic Tests and Procedures.*

P0171, P0174 — System Too Lean (Bank 1 and Bank 2)

Description	Refer to the *Ford Powertrain Control/Emissions Diagnosis Service Manual* for more descriptive information.
Possible Causes	• The LPA system was operated in the vapor region • Refer to the *Ford Powertrain Control/Emissions Diagnosis Service Manual* for a list of other causes.
Symptom	—
Diagnostic Aid	Verify that no LPA system faults are present and then follow the Ford service manual procedure.
Action	Refer to the *Fuel Pressure Drop Check* procedure in *Diagnostic Tests and Procedures*.

P03xx — Misfire

Description	Refer to the *Ford Powertrain Control/Emissions Diagnosis Service Manual* for more descriptive information.
Possible Causes	• The LPA system was operated in the vapor region • Refer to the *Ford Powertrain Control/Emissions Diagnosis Service Manual* for a list of other causes.
Symptom	—
Diagnostic Aid	Verify that no LPA system faults are present and then follow the Ford service manual procedure.
Action	Refer to the *Fuel Pressure Drop Check* procedure in *Diagnostic Tests and Procedures*.

Heated Exhaust Gas Oxygen Sensor

P2195, P2197 — Heated Exhaust Gas Oxygen Sensor Stuck

Description	Refer to the *Ford Powertrain Control/Emissions Diagnosis Service Manual* for more descriptive information.
Possible Causes	• The LPA system was operated in the vapor region • Refer to the *Ford Powertrain Control/Emissions Diagnosis Service Manual* for a list of other causes.
Symptom	—
Diagnostic Aid	Verify that no LPA system faults are present and then follow the Ford service manual procedure.
Action	Refer to the *Fuel Pressure Drop Check* procedure in *Diagnostic Tests and Procedures.*

Electronic Fuel Pump Relay (B)

U016C — Lost Communication with Fuel Pump Control Module B

Description	The SRM repeats the signal from the second EFPR to the PCM over the CAN bus. The PCM monitors this communication. If there is a lack of communication for a long enough period of time, a fault is set.
Possible Causes	• Wire fault between the EFPR and SRM • Wire fault between SRM and PCM • No power to the EFPR • SRM fault • CAN bus fault • Blown fuse • Refer to the *Ford Powertrain Control/Emissions Diagnosis Service Manual* for a list of other causes.
Symptom	—
Diagnostic Aid	—
Action	Refer to the *Fuel Pump Control Module Electrical Continuity Test* procedure and also the *Smart Relay Module Electrical Test* procedure in *Diagnostic Tests and Procedures*.

P027A — Fuel Pump Control Module Circuit Range/Performance

Description	The SRM receives the output of the second fuel pump monitor line and repeats the output over the CAN bus to the PCM. The PCM monitors the commanded output versus the monitor's feedback. If the monitor is out-of-range, a fault is set.
Possible Causes	• Refer to the *Ford Powertrain Control/Emissions Diagnosis Service Manual* for a list of other causes.
Symptom	Poor starts, rough idle, hesitation/surge.
Diagnostic Aid	—
Action	Refer to the *Fuel Pump Control Module Electrical Continuity Test* procedure in *Diagnostic Tests and Procedures*.

Integrated Pressure Temperature Sensor

P0182 — Fuel Temperature Sensor (A) Circuit Low

Description	The SRM reads the IPTS and passes the voltage reading over the CAN to the PCM monitors the voltage as if the sensor were plugged into the vehicle.
Possible Causes	• CAN bus fault between the SRM and PCM • Wiring fault between IPTS and SRM • Short in harness • VREF open or short • Low ambient temperature operation • Incorrect harness connection • Damaged IPTS (or FTS) • IPTS failure • SRM failure
Symptom	—
Diagnostic Aid	Verify the fuel rail temperature PID value to determine open or short.
Action	Refer to the *Integrated Pressure Temperature Sensor Electrical Check* procedure in *Diagnostic Tests and Procedures*.

P0183 — Fuel Temperature Sensor (A) Circuit High

Description	The SRM reads the IPTS and passes the voltage reading over the CAN bus to the PCM. The PCM monitors the voltage as if the sensor were plugged into the vehicle.
Possible Causes	• CAN bus fault between the SRM and PCM • Wiring fault between IPTS and SRM • Open circuit • Open or short to voltage in harness • Incorrect harness connection • Damaged IPTS (FTS) • IPTS failure • SRM failure
Symptom	—
Diagnostic Aid	Verify the fuel rail temperature PID value to determine open or short.
Action	Refer to the *Integrated Pressure Temperature Sensor Electrical Check* procedure in *Diagnostic Tests and Procedures*.

P0190 — Fuel Pressure Sensor A Circuit

Description	The SRM reads the IPTS and passes the voltage reading over the CAN bus to the PCM. The PCM monitors the voltage as if the sensor were plugged into the vehicle.
Possible Causes	• CAN bus fault between the SRM and PCM • Wiring fault between IPTS and SRM • VREF open in harness • VREF open in sensor • Vacuum leaks • IPTS failure • SRM failure
Symptom	—
Diagnostic Aid	VREF should be between 4–6 volts.
Action	Refer to the *Integrated Pressure Temperature Sensor Electrical Check* procedure in *Diagnostic Tests and Procedures*.

P0192 — Fuel Pressure Sensor A Circuit Low

Description	The SRM reads the IPTS and passes the voltage reading over the CAN bus to the PCM. The PCM monitors the voltage as if the sensor were plugged into the vehicle.
Possible Causes	• CAN bus fault between the SRM and PCM • Wiring fault between IPTS and SRM • IPTS FRP signal short to SIG RTN or PWR GND • Damaged IPTS (or FRP) • IPTS failure • SRM failure
Symptom	—
Diagnostic Aid	A FRP PID value during ignition ON, engine OFF, or ignition ON, engine running is less than 0.3 volt. This indicates a concern is present.
Action	Refer to the *Integrated Pressure Temperature Sensor Electrical Check* procedure in *Diagnostic Tests and Procedures*.

P0193 — Fuel Pressure Sensor A Circuit High

Description	The SRM reads the IPTS and passes the voltage reading over the CAN bus to the PCM. The PCM monitors the voltage as if the sensor were plugged into the vehicle.
Possible Causes	• CAN bus fault between the SRM and PCM • Wiring fault between IPTS and SRM • IPTS FRP signal short to VREF or VPWR • IPTS (or FRP) open signal • Damaged IPTS (or FRP) • IPTS failure • SRM failure
Symptom	—
Diagnostic Aid	Verify the FRP PID value to determine open or short.
Action	Refer to the *Integrated Pressure Temperature Sensor Electrical Check* procedure in *Diagnostic Tests and Procedures*.

Fuel Level Sender

P0460 — Fuel Level Sender A Circuit

Description	Refer to the *Ford Powertrain Control/Emissions Diagnosis Service Manual* for more descriptive information.
Possible Causes	Refer to the Ford service manual. Causes are the same except that communication is between the FLS and the SRM and not the IC.
Symptom	—
Diagnostic Aid	The SRM reads fuel level sender input and broadcasts it to the IC and PCM.
Action	Refer to the *Fuel Level Indication System Check* procedure in *Diagnostic Tests and Procedures*.

P0461 — Fuel Level Sender A Circuit Range/Performance

Description	Refer to the *Ford Powertrain Control/Emissions Diagnosis Service Manual* for more descriptive information.
Possible Causes	Refer to the Ford service manual. Causes are the same except that communication is between the sender and the SRM and not the IC.
Symptom	—
Diagnostic Aid	The SRM reads fuel level sender input and broadcasts it to the IC and PCM.
Action	Refer to the *Fuel Level Indication System Check* procedure in *Diagnostic Tests and Procedures*.

P0462 — Fuel Level Sender A Circuit Low

Description	Refer to the *Ford Powertrain Control/Emissions Diagnosis Service Manual* for more descriptive information.
Possible Causes	Refer to the Ford service manual. Causes are the same except that communication is between the sender and the SRM and not the IC.
Symptom	—
Diagnostic Aid	The SRM reads fuel level sender input and broadcasts it to the IC and PCM.
Action	Refer to the *Fuel Level Indication System Check* procedure in *Diagnostic Tests and Procedures*.

DIAGNOSTIC TESTS AND PROCEDURES

General Information

Measuring Fuel Rail and Fuel Tank Pressure

Measuring Fuel Tank Pressure — Fuel tank pressure can be measured two ways: Refer to *Tools and Equipment, Special Tools* in the *2012 Ford E-150/250/350/450 or 2013 F-250/350 Liquid Propane Autogas Fuel System Service Manual Supplement* for more information regarding the tools required.

Method 1 — Install a 0–500 psi (0–3447 kPa) fuel pressure gauge on the bleeder valve at the tank, or to the remote bleeder valve location. Open the valve to monitor the fuel tank pressure. Record the value.

Method 2 — If a 0–500 psi (0–3447 kPa) fuel pressure gauge is not available, fuel rail pressure can be used to infer fuel tank pressure. Refer to M*ethod 1* of *Measuring Fuel Rail Pressure*. Monitor fuel rail pressure with the engine running. Turn the engine off and continue to monitor fuel rail pressure. When the pressure has stabilized, record the value as fuel tank pressure.

Measuring Fuel Rail Pressure — Fuel rail pressure can be measured two ways: Refer to *Tools and Equipment, Special Tools* in the *2012 Ford E-150/250/350/450 or 2013 F-250/350 Liquid Propane Autogas Fuel System Service Manual* for more information regarding the tools required.

Method 1 — Using the OBD-II scan tool, read the fuel rail pressure PID. If using the Ford IDS tool, it will be necessary to select the tool box tab, then select Powertrain near bottom of selection, OBD Test Modes, Mode 1 Powertrain Data. Then locate and select FRP (pressure) from PID selection table.

Method 2 — Empty the fuel rails and fuel lines. Refer to the *Fuel Line Purging Procedure* in the *2012 Ford E-150/250/350/450 or 2013 F-250/350 Liquid Propane Autogas Fuel System Service Manual Supplement* for more information. Using the Jiffy-Tite disconnect tool, disconnect the fuel supply line at the rear of the RH fuel rail. Install the ROUSH service port adapter between the fuel line and the fuel rail. Attach 0–500 psi (0–3447 kPa) fuel pressure gauge to the service port on the adapter. Record the value.

Expected Fuel Tank Pressure — On a tank at ambient temperature conditions, the following pressures can be expected:

Temperature (°F)	Pressure (psi)		
	Min.	Nominal	Max.
0	15	25	35
5	19	29	39
10	23	33	43
15	28	38	48
20	33	43	53
25	38	48	58
30	43	53	63
35	49	59	69
40	55	65	75
45	62	72	82
50	69	79	89
55	77	87	97
60	84	94	104
65	93	103	113
70	102	112	122
75	111	121	131
80	121	131	141
85	131	141	151
90	142	152	162
95	153	163	173
100	165	175	185
105	178	188	198
110	191	201	211
115	205	215	225
120	219	229	239

NOTE

On vehicles that have been operated for extended periods of time, the tank (fuel) can be much warmer and so higher pressures are to be expected.

Expected Fuel Rail Pressure — Under normal operating conditions, the fuel pump has two operating speeds. The pump operates in low speed mode at idle and during moderate fuel flow/part throttle driving. Once a fuel demand threshold is met, typically during wide open throttle (WOT) operation, the pump is switched to high speed. The pump is also operated at high speed during the pre-start flush sequence.

The fuel pressure controls are designed to keep the rails at a certain pressure over tank pressure, therefore, it is important to measure tank pressure prior to collecting fuel rail pressure data. For example, if the fuel tank is at 150 psi (1034 kPa) and pressure in the rail is measured at 200 psi (1379 kPa), the rail is running at 50 psi (345 kPa) over tank.

Condition	Pump Speed	Pressure Over Tank
Engine Off	Off	<10
Idle	Low	>30
Part Throttle	Low	<25
Part Throttle	High	>25
WOT	High	>25

NOTE

Under extreme operating conditions, there is a third pump mode. In the event that the fuel system has degraded and the sensor detects vapor, or if the fuel rail pressure is approaching the limit of the fuel system, the pump runs in a variable speed mode, controlling to a target pressure. In this mode there is no predicted rise over tank pressure. The fuel pump will adjust the pressure to maintain a required operating pressure. This condition will likely result in a P116E or P0148 code.

No Fill

Step	Procedure	Action
1	**Inspect vehicle to check for kinked fill lines.** Are fill lines kinked?	**Yes** — Replaced kinked fill lines. **No** — Go to Step 2.
2	**Determine the location of the overflow protection device (OPD).** Is the OPD located in the end cap of the fuel tank?	**Yes** — Go to Step 3. **No** — Go to Step 6.
3	**Check the fuel gauge in the instrument cluster.** Is the gauge indicating less than 1/4 full?	**Yes** — Go to Step 4. **No** — Go to Step 6.
4	**Check to see if the OPD is being activated.** **NOTE** Fuel splashing off the sides of the empty tank could be activating the OPD float and shutting off the fuel fill line. a. Loosen the fuel fill line at the fill valve or at the inlet to the fuel filter to relieve any pressure in the fill line and release the OPD valve. Retighten the fill line. b. Install a fuel fill pressure tester on the fill valve and close the ball valve. c. Connect the fuel dispensing nozzle to the pressure tester and turn on the pump. Slightly open the ball valve to slowly add approximately 10 gal (38 L) of fuel. d. Did the tank fill?	**Yes** — Go to Step 5. **No** — Go to Step 6.
5	**Remove the fuel fill pressure tester and attempt to fill the vehicle fuel tank to full 80% capacity.** Does the vehicle fuel tank fill to capacity?	**Yes** — Diagnostic is complete. **No** — Go to Step 6.
6	**Check the fuel gauge in the instrument cluster.** Is the gauge indicating more than 1/2 full?	**Yes** — Go to Step 7. **No** — Go to Step 11.
7	**Reverse direction of vehicle at the pump and try to fill the vehicle.** Does the vehicle fuel tank fill?	**Yes** — Vehicle not on level ground. Diagnostic is complete. **No** — Drive vehicle until fuel gauge indicates less than 1/2 full and go to Step 8.

Step	Procedure	Action
8	**Attempt to fill the vehicle fuel tank.** Does the fuel tank fill?	**Yes** — Go to Step 9. **No** — Go to Step 11.
9	**Open bleeder valve.** Does liquid fuel vent?	**Yes** — Go to Step 10. **No** — Go to Step 12.
10	**Check fuel gauge.** Does fuel gauge read full?	**Yes** — Diagnostic complete. **No** — Refer to *Fuel Level Indicator Check*.
11	**Check for sufficient fill station pressure.** a. Connect pressure gauge service tool to the fuel tank bleeder valve and record pressure. b. Using a fuel fill pressure tester installed on the fill valve, attempt to fill the vehicle. c. With the dispensing pump on and dispensing nozzle open, measure and record fill station pump pressure. d. Is fill station pump pressure at least 20 psi (138 kPa) greater than tank pressure?	**Yes** — Go to Step 12. **No** — Fill station may not be providing enough pressure to fill. Go to Step 19.
12	**Check body side fuel fill valve; it may be stuck closed.** a. Loosen the fuel fill line connection at the fill valve or at the inlet to the fuel filter to relieve any pressure in the fill line. b. Attempt to push open the piston in the fill valve to determine if it is stuck closed. c. Is the fill valve piston stuck closed?	**Yes** — Replace body-side fill valve and go to Step 13. **No** — Replace filter in the fuel fill line and go to Step 15.
13	**Attempt to fill the vehicle fuel tank.** Does the fuel tank fill?	**Yes** — Diagnostic is complete. **No** — Go to Step 14.
14	**Replace the filter in the fuel fill line and then attempt to fill the vehicle fuel tank.** Does the vehicle fuel tank fill?	**Yes** — Diagnostic is complete. **No** — Go to Step 16.
15	**Attempt to fill the vehicle fuel tank.** Does the fuel tank fill?	**Yes** — Diagnostic is complete. **No** — Go to Step 16.
16	**Replace the OPD valve in the vehicle fuel tank.** Is the OPD valve located in the end cap of the fuel tank?	**Yes** — Go to Step 17. **No** — Go to Step 18.
17	**Attempt to fill the vehicle fuel tank as follows:** **NOTE** When filling a new tank that has the OPD valve mounted in the end cap of the fuel tank, fuel splashing off the sides of the empty tank could be activating the OPD float and shutting off the fuel fill line. a. Install a fuel fill pressure tester on the fill valve and close the ball valve. b. Connect the fuel dispensing nozzle to the pressure tester and turn on the pump. Slightly open the ball valve to slowly add approximately 10 gal (38 L) of fuel. c. Remove the fuel fill pressure tester. d. Attempt to fill the remaining tank volume (to 80% full capacity) at full flow from the dispensing nozzle. e. Did the tank fill?	**Yes** — Diagnostic is complete. **No** — Call ROUSH CleanTech Customer Service at 800-597-6874.
18	**Attempt to fill the vehicle fuel tank.** Does the fuel tank fill?	**Yes** — Diagnostic is complete. **No** — Call ROUSH CleanTech Customer Service at 800-597-6874.

Step	Procedure	Action
19	**Fill station is not providing enough pressure to fill.** a. Using the tables provided at the front of this section, determine expected propane tank pressure based on ambient temperature. b. Is the vehicle fuel tank pressure greater than 20 psi (138 kPa) over the nominal expected pressure?	**Yes** — Go to Step 20. **No** — Locate a dispensing facility with pump output capacity in excess of 100 psi (689 kPa) (preferably an Auto Gas-type facility). Then, go to Step 12.
20	**Vehicle fuel tank is at a higher pressure.** a. Higher pressure is likely caused by heavy vehicle usage heating the fuel. b. Allow the vehicle (fuel tank) to cool and then recheck pressure in the fuel tank.	When tank pressure is within 10 psi (69 kPa) of expected tank pressure, go to Step 21.
21	**Measure and compare vehicle fuel tank and fill station pressures.** a. Connect a pressure gauge service tool to the fuel tank bleeder valve and record fuel tank pressure. b. Using a fuel fill pressure tester installed on the fill valve, attempt to fill the vehicle. c. With the dispensing pump on and dispensing nozzle open, measure and record fill station pump pressure. d. Is fill station pump pressure at least 20 psi (138 kPa) greater than fuel tank pressure?	**Yes** — Go to Step 22. **No** — Fill station is not providing enough pressure to fill vehicle tank. Go to Step 22. Locate a dispensing facility with pump output capacity in excess of 100 psi (689 kPa) (preferably an Auto Gas-type facility).
22	**Attempt to fill the vehicle fuel tank.** Does the fuel tank fill?	**Yes** — Diagnostic is complete. **No** — Go to Step 12.

Slow Fill

Step	Procedure	Action
1	**Inspect vehicle to check for kinked fill lines.** Are fill lines kinked?	**Yes** — Replaced kinked fill lines. **No** — Go to Step 2.
2	**Determine flow rate at which the vehicle fuel system fills.** a. Time the fill station pump for 10 seconds and record the number of gallons dispensed. b. Multiply the gallons dispensed by six to determine the flow rate in gallons per minute. c. Is the fill station pump flow rate at least 6 gal (23 L) per minute?	**Yes** — System fill rate is OK; diagnostic is complete. **No** — Fill station is not providing enough pressure to fill vehicle tank. Go to Step 3.
3	**Measure and compare vehicle fuel tank and fill station pressures.** a. Connect a pressure gauge service tool to the fuel tank bleeder valve and record fuel tank pressure. b. Using a fuel fill pressure tester installed on the fill valve, attempt to fill the vehicle. c. With the dispensing pump on and dispensing nozzle open, measure and record fill station pump pressure. d. Is fill station pump pressure at least 50 psi (345 kPa) greater than fuel tank pressure?	**Yes** — Go to Step 4. **No** — Fill station is not providing enough pressure to fill vehicle tank. Go to Step 11.
4	**Check fuel fill valve; it may not be opening completely.** a. Loosen the fuel fill line connection at the fill valve or at the inlet to the fuel filter to relieve any pressure in the fill line. b. Attempt to push open the piston in the fill valve to determine if it is opening completely. Piston should travel 1/4 inch. c. Is the fill valve piston opening completely?	**Yes** — Replace the filter in the fuel fill line and then go to Step 7. **No** — Replace the fuel fill valve and then go to Step 5.
5	**Attempt to fill the vehicle fuel tank.** Does the fuel tank fill at greater than six gal (23 L) per minute?	**Yes** — Diagnostic is complete. **No** — Go to Step 6.

Step	Procedure	Action
6	**Replace the filter in the fuel fill line.** Does the vehicle fuel tank fill at greater than six gal (23 L) per minute?	**Yes** — Diagnostic is complete. **No** — Go to Step 7.
7	**Attempt to fill the vehicle fuel tank.** Does the fuel tank fill at greater than six gal (23 L) per minute?	**Yes** — Diagnostic is complete. **No** — Go to Step 8.
8	**Replace the overfill protection device (OPD) valve in the vehicle fuel tank.** Is the OPD valve located in the end cap of the fuel tank?	**Yes** — Go to Step 9. **No** — Go to Step 10.
9	**Attempt to fill the vehicle fuel tank as follows:** **NOTE** When filling a new tank that has the OPD valve mounted in the end cap, fuel splashing off the sides of the empty tank could be activating the OPD float and shutting off the fuel fill line. a. Install a fuel fill pressure tester on the fill valve and close the ball valve. b. Connect the fuel dispensing nozzle to the pressure tester and turn on the pump. Slightly open the ball valve to slowly add approximately 10 gal (38 L) of fuel. c. Remove the fuel fill pressure tester. d. Attempt to fill the remaining tank volume (to 80% full capacity) at full flow from the dispensing nozzle. a. Did the tank fill?	**Yes** — Diagnostic is complete. **No** — Call ROUSH CleanTech Customer Service at 800-597-6874.
10	**Attempt to fill the vehicle fuel tank.** Does the fuel tank fill at greater than six gal (23 L) per minute?	**Yes** — Diagnostic is complete. **No** — Call ROUSH CleanTech Customer Service at 800-597-6874.
11	**Fill station is not providing enough pressure to fill.** a. Using the tables provided at the front of this section, determine expected propane tank pressure based on ambient temperature. b. Is the vehicle fuel tank pressure greater than 20 psi (38 kPa) over the nominal expected pressure?	**Yes** — Go to Step 12. **No** — Locate a dispensing facility with pump output capacity in excess of 100 psi (689 kPa) (preferably an Auto Gas-type facility). Then, go to Step 2.
12	**Vehicle fuel tank is at a higher pressure.** a. Higher pressure is likely caused by heavy vehicle usage heating the fuel. b. Allow the vehicle (fuel tank) to cool and then recheck pressure in the fuel tank.	When tank pressure is within 10 psi (69 kPa) of expected tank pressure, go to Step 13.
13	**Measure and compare vehicle fuel tank and fill station pressures.** a. Connect a pressure gauge service tool to the fuel tank bleeder valve and record fuel tank pressure. b. Using a fuel fill pressure tester installed on the fuel fill valve, attempt to fill the vehicle. c. With the dispensing pump on and dispensing nozzle open, measure and record fill station pump pressure. d. Is fill station pump pressure at least 50 psi (345 kPa) greater than fuel tank pressure?	**Yes** — Go to Step 14. **No** — Fill station is not providing enough pressure to fill vehicle tank. Go to Step 14. Locate a dispensing facility with pump output capacity in excess of 100 psi (689 kPa) (preferably an Auto Gas-type facility).
14	**Attempt to fill the vehicle fuel tank.** Does the fuel tank fill at greater than six gal (23 L) per minute?	**Yes** — Diagnostic is complete. **No** — Go to Step 4.

Over Fill

Step	Procedure	Action
1	**Suspect overfill because fuel fill volumes achieved during refueling exceed the rated fuel capacity or excessive vehicle range between refueling.** a. Check the fuel gauge. b. Is the gauge reading below 1/2 tank?	**Yes** — Go to Step 2. **No** — Drive vehicle until gauge reads below 1/4 tank.
2	**Open bleeder valve located on the tank or remotely mounted on the vehicle.** a. Listen at valve to verify propane vapor is venting. b. Is propane vapor venting?	**Yes** — Go to Step 3. **No** — Bleeder valve is not functioning properly. Replace the valve.
3	**Park the vehicle at the refueling station.** a. Check to determine if the vehicle is level using the vehicle frame as reference. b. Does the vehicle sit level?	**Yes** — Go to Step 4. **No** — Using a jack, raise the vehicle to obtain a level condition. Then, go to Step 4.
4	**Locate the American Society of Mechanical Engineers (ASME) inspection plate on the fuel tank.** a. Note the tank water capacity listed on the plate. b. Multiply the listed capacity by 0.05 (5%) and record the value.	With the value recorded, go to Step 5.
5	**Refuel the vehicle as follows:** **NOTE** If the key is on during refueling, it will take the fuel level gauge in the instrument cluster longer to register full. a. Verify that the ignition is in the off position. b. Install the fuel fill pressure tester on the fill valve and close the ball valve. c. Connect the fuel dispensing nozzle to the pressure tester. Verify that the bleeder valve is open. d. With the bleeder valve open, turn on the pump. Open the ball valve slightly to very slowly refuel the vehicle. e. While refueling, observe the bleeder valve for fuel discharge. f. Stop filling when a solid stream of liquid fuel flows from the bleeder valve or the dispensing pump stops automatically. g. Did a solid stream of liquid flow from the bleeder valve?	**Yes** — Record the volume of fuel dispensed and then go to Step 6. **No** — Go to Step 7.
6	**Resume filling until the dispensing pump stops automatically.** a. Record the total volume of fuel dispensed and subtract the amount from the volume recorded in Step 5. b. Is the additional amount of fuel dispensed less than 5% of the tank water capacity determined in Step 4?	**Yes** — Tank does not overfill. Diagnostic is complete. **No** — Tank is overfilling. Replace the OPD fill valve in the fuel tank; then, go to Step 8.
7	**The dispensing pump stopped automatically and a liquid fuel stream was not observed flowing from bleeder valve.**	Tank does not overfill. Diagnostic is complete.

Step	Procedure	Action
8	**Refuel the vehicle as follows:** **NOTE** If the key is on during refueling, it will take the fuel level gauge in the instrument cluster longer to register full. a. Verify that the ignition is in the off position. b. Install the fuel fill pressure tester on the fill valve and close the ball valve. c. Connect the fuel dispensing nozzle to the pressure tester. Verify that the bleeder valve is open. d. With the bleeder valve open, turn on the pump. Open the ball valve slightly to very slowly to refuel the vehicle. e. While refueling, observe the bleeder valve for fuel discharge. f. Stop filling when a solid stream of liquid fuel flows from the bleeder valve or the dispensing pump stops automatically. g. Did a solid stream of liquid flow from the bleeder valve?	**Yes** — Record the volume of fuel dispensed and then go to Step 9. **No** — Go to Step 7.
9	**Resume filling until the dispensing pump stops automatically.** a. Record the volume of fuel dispensed and subtract the amount from the volume recorded in Step 8. b. Is the additional amount of fuel dispensed less than 5% of the tank water capacity determined in Step 4?	**Yes** — Tank does not overfill. Diagnostic is complete. **No** — Tank is overfilling. Replace the fuel tank assembly.

Engine Does Not Crank

Step	Procedure	Action
1	**Is battery voltage above 10 volts?**	**Yes** — Go to Step 2. **No** — Determine cause of low battery voltage.
2	**Verify that the smart relay module (SRM) has communication.** Can fuel rail pressure and temperature be read with a scan tool?	**Yes** — Go to Step 3. **No** — Go to the *Smart Relay Module Electrical Test* procedure.
3	**Refer to the *Ford Powertrain Control/Emission Diagnosis Service Manual*.** Is the problem corrected?	**Yes** — Diagnostic is complete. **No** — Call ROUSH CleanTech Customer Service at 800-597-6874.

Engine Cranks, No Start

NOTE

For harness and connector layout diagrams and system electrical schematics, refer to *System Wiring Diagrams* and to *System Electrical Schematics*.

Step	Procedure	Action
1	**Verify the following:** a. Is there fuel in the tank of at least 1/8 tank or more? (add fuel if necessary). b. Is the tank supply manual shutoff valve fully open? c. Is battery voltage above 10 volts?	**Yes** — Go to Step 2. **No** — Correct fault and retry.
2	**Check for diagnostic trouble codes (DTC).** Are any codes present?	**Yes** — Go to Step 3. **No** — Go to Step 4.
3	**Is the DTC identified on the ROUSH LPA DTC list?**	**Yes**— Refer to *Diagnostic Trouble Codes*. **No** — Refer to Ford service manual DTC chart.
4	**Check fuel pressure.** a. Measure and record fuel rail and fuel tank pressure, key on, engine off (KOEO). b. While monitoring fuel pressure, attempt to start engine. c. Record the highest pressure observed. d. Does fuel pressure rise 25 psi (172 kPa) before engine crank?	**Yes** — Go to Step 11. **No** — Go to Step 5.
5	**Check fuel pump operation.** a. Using a current clamp, check current draw on both fuel pump power wires at the fuel tank. Refer to *In-Tank Harness* for correct circuits. b. Turn ignition switch to start position and release. Vehicle will start the flush cycle and pumps should be running. Check current draw. A minimum of 2 amps should be recorded on both fuel pump circuits. c. Do fuel pumps draw current?	**Yes** — Go to Step 6. **No** — If both circuits are showing no current, check the OEM fuel pump (FP) fuse. If only one fuel pump circuit shows current, check the ROUSH CleanTech fuel pump fuse. (See ROUSH CleanTech fuse box for location.) If both fuel pump fuses (OEM and ROUSH CleanTech) are good, go to Step 10.
6	**Check excess flow valve (XFV).** a. Turn ignition key to the OFF position. b. Close the manual shutoff valve on tank. c. Wait 1 minute and then slowly open manual shutoff valve. d. Measure and record fuel pressure, using a scan tool, at integrated pressure temperature sensor (IPTS). e. Is problem resolved?	**Yes** — Go to Step 11. **No** — Go to Step 7.
7	**Check ROUSH fuel pump (FP) fuse.** Is fuse intact and OK?	**Yes** — Go to Step 8. **No** — Determine the cause of the short and repair; replace the fuse. Diagnostic is complete.
8	**Check the tank solenoid (TS) and supply solenoid (SS) fuses.** a. Locate the TS fuse (E3-E4) and check its condition. b. Locate the SS fuse (F1-F2) and check its condition. c. Are the fuses blown?	**Yes** — Determine the cause of the short and repair; replace the fuse. **No** — Go to Step 9.

Step	Procedure	Action
9	**Verify that there is power and proper grounding at the tank solenoid (TS) and supply solenoid (SS) wiring circuits.** a. Check for +12 volts at the TS and SS connectors. Refer to the *Tank Solenoid Electrical Check* procedure. b. Is +12 volts present at the TS connector? c. Is +12 volts present at the SS connector?	**Yes** — Voltage present at SS, replace FRPCM. Voltage present at TS, replace fuel supply valve assembly. **No** — Check for an open(s) in the wiring circuits and repair. Diagnostic is complete.
10	**Verify that there is power and proper grounding in the wiring circuit to the tank.** a. Check for +12 volts at the fuel pump 1 (FP1) and fuel pump 2 (FP2) connectors. Refer to the *Fuel Pump Electrical Check* procedure. b. Is +12 volts present at the FP1 connector? c. Is +12 volts present at the FP2 connector?	**Yes** — Go to Step 12. **No** — Check for an open(s) in the wiring circuits and repair.
11	**Integrated Pressure Temperature Sensor Rationality** Does temperature and pressure make sense to verification procedure?	**Yes** — Refer to the *Integrated Pressure Temperature Sensor Electrical Check*. **No** — Verify that wiring in circuit is OK. Refer to the *Integrated Pressure Temperature Sensor Electrical Check* procedure. If not, repair wiring. If OK, replace sensor.
12	**Check wiring.** a. Drain the propane from the fuel tank. Refer to the *Fuel Tank Draining Procedure* in the appropriate *ROUSH CleanTech Service Manual* for more information. b. Remove tank service cover. c. Check for open or short circuits on tank pass-through harness. d. Is a wiring problem present?	**Yes** — Replace harness. **No** — Go to Step 13.
13	**Check fuel hoses and quick-connect fittings.** • Are in-tank fuel hoses and quick-connect fittings connected and in good condition?	**Yes** — Replace fuel pump assembly. **No** — Replace hose assemblies as needed.

Engine Stumble, Stall, Rough Idle

NOTE

For harness and connector layout diagrams and system electrical schematics, refer to *System Wiring Diagrams* and to *System Electrical Schematics*.

Step	Procedure	Action
1	**Verify the following:** a. Is there fuel in the tank of at least 1/8 tank or more? (Add fuel if necessary.) b. Is the tank supply manual shutoff valve fully open? c. Is battery voltage above 11 volts with engine running?	**Yes** — Go to Step 2. **No** — Correct the fault and retry.
2	**Check for diagnostic trouble codes (DTCs).** Are any codes present?	**Yes** — Go to Step 3. **No** — Go to Step 4.
3	**Identify the DTC.** a. Is the DTC covered in the ROUSH CleanTech DTC listing for LPA-fueled vehicles? b. Correct all DTCs before continuing.	**Yes** — Refer to ROUSH CleanTech *Diagnostic Trouble Codes*. **No** — Refer to the appropriate *Ford Powertrain Control/Emissions Diagnosis Service Manual* at www.motorcraft.com.
4	**Does the problem occur only after cold start?**	**Yes** — Go to Step 6. **No** — Go to Step 5.
5	**Determine fuel pressure.** a. Measure tank pressure with key on and engine off (KOEO). b. Measure fuel rail pressure with key on and engine running (KOER). c. Subtract the KOEO pressure from the KOER pressure to obtain the difference. Compare to the chart in *Expected Fuel Rail Pressure*. d. Is the resulting fuel pressure reading within the expected range?	**Yes** — Go to Step 7. **No** — Go to Step 6.
6	**Determine if the excess flow valve (XFV) is tripped.** a. Turn off the engine. b. Wait one minute and then restart the engine. c. Is the fault condition resolved?	**Yes** — Refer to the *Excess Flow Valve Check* procedure. **No** — Go to Step 7.
7	**Check fuel pump operation.** a. Using a current clamp, check current draw on both fuel pump power wires at the fuel tank. Refer to *In-Tank Harness* for correct circuits. b. Turn ignition switch to start position and release. Vehicle will start the flush cycle and pumps should be running. Check current draw. A minimum of 2 amps should be recorded on both fuel pump circuits. c. Do fuel pumps draw current?	**Yes** — Go to Step 11. **No** — If both circuits are showing no current, check the OEM fuel pump (FP) fuse. If only one fuel pump circuit shows current, check the ROUSH CleanTech fuel pump fuse. (See ROUSH CleanTech fuse box for location.) If both fuel pump fuses (OEM and ROUSH CleanTech) are good, go to Step 8.
8	**Verify that there is power and proper grounding in the wiring circuit to the tank.** a. Check for +12 volts at the fuel pump 1 (FP1) and fuel pump 2 (FP2) connectors. Refer to the *Fuel Rail Pressure Control Module Electrical Check* procedure. b. Is +12 volts present at the FP1 connector? c. Is +12 volts present at the FP2 connector?	**Yes** — Go to Step 9. **No** — Check for an open/short in the wiring circuit and repair.

Step	Procedure	Action
9	**Check wiring.** a. Drain the propane from the fuel tank. Refer to the *Fuel Tank Draining Procedure* in the appropriate *ROUSH CleanTech Service Manual* for more information. b. Remove tank service cover. c. Check for open or short circuits on tank pass-through harness. d. Is a wiring problem present?	**Yes** — Replace harness. **No** — Go to Step 10.
10	**Check fuel hoses and quick-connect fittings.** • Are in-tank fuel hoses and quick-connect fittings connected and in good condition?	**Yes** — Replace fuel pump assembly. **No** — Replace hose assemblies as needed.
11	**Integrated Pressure Temperature Sensor Rationality** Does temperature and pressure make sense to verification? Refer to the *Integrated Pressure Temperature Sensor Electrical Check* procedure.	**Yes** — Go to Step 12. **No** — Verify that wiring in circuit is OK. If not, repair wiring. If OK, replace sensor.
12	Refer to the appropriate *Ford Powertrain Control/Emissions Diagnosis Service Manual* at www.motorcraft.com.	—

Excess Flow Valve Check

The excess flow valve (XFV) is designed to restrict fuel exiting the tank if the pump is energized while the fuel lines are not connected to the fuel tank. Under normal circumstances, the XFV should not trip. The XFV will reset itself after the fuel pumps have been off for about one minute.

It is common to trip the XFV after the fuel lines have been serviced and contain no pressure. If the XFV trips, turn the vehicle off, wait one minute, and restart. This may take more than one attempt.

If the fuel lines have not been serviced recently and the problem persists, there may be a leak in the supply side fuel line. If the problem is only present after the vehicle has been sitting for a length of time, but not present during a short soak, or there is a propane odor when the vehicle is running, refer to the *Fuel Line Leak Detection* procedure.

Step	Procedure	Action
1	**Verify fuel supply line pressure prior to cranking engine.** a. Read fuel rail pressure and tank pressure. b. Energize bleed solenoid until rail pressure is at least 50 psi (345 kPa) below tank pressure. If rail is bled, skip to Step D. c. Let pressure stabilize for 1 minute. d. Open the supply solenoid. e. Read fuel rail pressure and tank pressure. f. Does fuel rail pressure jump to tank pressure?	**Yes** — Check is OK. **No** — Repair the leak in the fuel supply line.

Maximum Pressure Check

The LPA system operates over a wide range of pressures depending on ambient temperature, driving mode, etc. When the vehicle is subjected to a severe drive cycle in high ambient temperatures, the fuel rail pressure can rise to the limit of the injectors capabilities. This limit is a function of injector voltage and fuel rail pressure. The PCM protects for this condition by reducing the fuel pump speed when the condition is sensed, however, there still may be drive concerns. When the PCM starts controlling the fuel pump a P116E code is set. While this condition can occur in a normally functioning vehicle, it can also be exacerbated by several factors. If the fuel tank was not properly bled during the first fill, trapped air in the vapor space can increase tank pressure. In this condition there is often only a faint smell of propane when the bleeder valve is opened. The tank should be vented until there is a strong propane odor coming from the bleeder valve. The tank pressure should be confirmed against the expected pressure.

Allow the fuel tank to cool to ambient temperature before performing the following procedure.

Step	Procedure	Action
1	**Measure tank pressure and tank surface temperature.** Is tank pressure more than 15 psi (103 kPa) over expected tank pressure?	**Yes** — Vent the tank until pressure is within the expected range. **No** — Vehicle is working properly; inform and explain operating characteristics to customer.

Supply Solenoid Check

NOTE

For harness and connector layout diagrams and system electrical schematics, refer to *System Wiring Diagrams* and to *System Electrical Schematics*.

Step	Procedure	Action
1	**Verify the following:** a. Is there fuel in the tank of at least 1/8 tank or more? (Add fuel if necessary.) b. Is the tank supply manual shutoff valve fully open? c. Is battery voltage above 10 volts?	**Yes** — Go to Step 2. **No** — Correct fault and retry.
2	**Check for diagnostic trouble codes (DTC).** Are any codes present?	**Yes** — Go to Step 3. **No** — Go to Step 4.
3	**Is the DTC identified on the ROUSH liquid propane autogas DTC list?**	**Yes** — Refer to *Diagnostic Trouble Codes*. **No** — Refer to the Ford service manual DTC chart.
4	**Check fuel pressure.** a. Measure and record fuel rail pressure and fuel tank pressure at key on, engine off (KOEO). b. While monitoring fuel pressure, attempt to start engine. c. Record the highest pressure observed. d. Does fuel pressure rise 20 psi (138 kPa) before engine crank?	**Yes** — Go to Step 11. **No** — Go to Step 5.

Step	Procedure	Action
5	**Check fuel pump operation.** a. Using a current clamp, check current draw on both fuel pump power wires at the fuel tank. Refer to *In-Tank Harness* for correct circuits. b. Turn ignition switch to start position and release. Vehicle will start the flush cycle and pumps should be running. Check current draw. A minimum of 2 amps should be recorded on both fuel pump circuits. a. Do fuel pumps draw current?	**Yes** — Go to Step 6. **No** — If both circuits are showing no current, check the OEM fuel pump (FP) fuse. If only one fuel pump circuit shows current, check the ROUSH CleanTech fuel pump fuse. (See ROUSH CleanTech fuse box for location.) If both fuel pump fuses (OEM and ROUSH CleanTech) are good, go to Step 10.
6	**Check XFV.** a. Turn off engine. b. Wait 1 minute and then restart engine. c. Measure and record fuel rail pressure and fuel tank pressure. d. Is problem resolved?	**Yes** — Go to Step 11. **No** — Go to Step 7.
7	**Check ROUSH FP fuse.** Is fuse intact and OK?	**Yes** — Go to Step 8. **No** — Determine the cause of the short and repair; replace the fuse.
8	**Check the TS and SS fuses.** a. Locate the TS fuse (E3-E4) and check its condition. b. Locate the SS fuse (F1-F2) and check its condition. c. Are the fuses blown?	**Yes** — Determine the cause of the short and repair; replace the fuse. **No** — Go to Step 9.
9	**Verify that there is power and grounding in the TS and SS wiring circuits.** a. Check for +12 volts at the TS and SS connectors. Refer to the *Tank Solenoid Electrical Check* procedure. b. Is +12 volts present at the TS connector? c. Is +12 volts present at the SS connector?	**Yes** — Voltage present at SS, replace FRPCM. Voltage present at TS, replace fuel supply valve assembly. **No** — Check for an open/short in the wiring circuit and repair.
10	**Verify that there is power and grounding in the wiring circuit to the tank.** a. Check for +12 volts at the fuel pump 1 (FP1) and fuel pump 2 (FP2) connectors. Refer to the *Fuel Rail Pressure Control Module Electrical Check* procedure. b. Is +12 volts present at the FP1 connector? c. Is +12 volts present at the FP2 connector?	**Yes** — Refer to *Engine Stumble, Stall, Rough Idle* Step 12. **No** — Check for an open/short in the wiring circuit and repair.
11	**Integrated Pressure Temperature Sensor Rationality** Does temperature and pressure make sense to verification?	**Yes** — Go to Step 12. **No** — Verify that wiring in circuit is OK. Refer to the *Integrated Pressure Temperature Sensor Electrical Check* procedure. If not, repair wiring. If OK, replace sensor.
12	Refer to the appropriate *Ford Powertrain Control/Emissions Diagnosis Service Manual* at www.motorcraft.com.	—

Fuel System Fails to Bleed

Step	Procedure	Action
1	**Determine if fault condition repeats.** a. Start the engine and allow it to run for a few minutes. b. Turn off the engine and wait one minute. c. Measure and record the fuel rail pressure, fuel rail temperature and fuel tank pressure with the engine off (KOEO). d. Energize the bleed solenoid. Refer to the *Manual Solenoid Activation Procedure*. e. With the engine off, monitor fuel rail pressure for 15 minutes. f. Does fuel rail pressure drop more than 20 psi (138 kPa)?	**Yes** — Go to Step 5. **No** — Go to Step 2.
2	**Verify solenoid/restrictor function.** a. Start the engine and allow it to run for a few minutes. b. Turn off the engine. c. Disconnect the EVAP line from the FRPCM port. d. Energize the bleed solenoid. Refer to the *Manual Solenoid Activation Procedure*. e. Is there propane flowing from the port?	**Yes** — Go to Step 4. **No** — Go to Step 3.
3	**Verify that wiring is in good condition and functioning.** a. Perform wiring checks of the FRPCM harness. b. Is the wiring OK?	**Yes** — Bleed solenoid stuck closed or port restrictor is plugged. Replace the FRPCM. **No** — Repair wiring and repeat Step 1.
4	**Check for a kinked EVAP line.** a. Inspect the EVAP line between the FRPCM and EVAP canister. b. Are there kinks in the line?	**Yes** — Replace the kinked EVAP line and then repeat Step 1. **No** — Go to Step 5.
5	**Check for leaks to the FRPCM.** a. Start the engine and allow it to run for a few minutes. b. Turn off the engine and unplug the FRPCM. c. Measure and record fuel rail pressure. d. Bleed pressure from fuel rail until fuel pressure drops more than 50 psi (345 kPa). e. De-energize bleed solenoid. f. Let vehicle sit for 30 minutes. g. Measure fuel rail pressure and fuel tank pressure. h. Does fuel rail pressure rise more than 10 psi (69 kPa)?	**Yes** — FRPCM leaks at either supply solenoid or return check valve. Replace FRPCM. **No** — Potential intermittent fault. Return vehicle to customer and see if problem persists.

Fuel Pressure Drop

NOTE

For harness and connector layout diagrams and system electrical schematics, refer to *System Wiring Diagrams* and to *System Electrical Schematics*.

Step	Procedure	Action
1	**Verify the following:** a. Is there fuel in the tank of at least 1/8 tank? b. Is the tank supply manual shutoff valve fully open? c. Is battery voltage above 10 volts?	**Yes** — Go to Step 2. **No** — Correct the fault condition and retry.
2	**Determine fuel pressure.** a. Measure and record fuel tank pressure. b. Measure and record fuel rail pressure with key on, engine running (KOER). c. Subtract the tank measurement from the KOER measurement. d. Is the resulting fuel pressure in the expected range?	**Yes** — Go to Step 4. **No** — Go to Step 3.
3	**Determine if the excess flow valve is tripped.** a. Turn off the engine. b. Wait one minute and then restart the engine. c. Is the problem resolved?	**Yes** — Refer to the *Excess Flow Valve Check* procedure. **No** — Go to Step 4.
4	**Check fuel pump operation.** a. Using a current clamp, check current draw on both fuel pump power wires at the fuel tank. Refer to *In-Tank Harness* for correct circuits. b. Turn ignition switch to start position and release. Vehicle will start the flush cycle and pumps should be running. Check current draw. A minimum of 2 amps should be recorded on both fuel pump circuits. c. Do fuel pumps draw current?	**Yes** — Go to Step 5. **No** — If both circuits are showing no current, check the OEM fuel pump (FP) fuse. If only one fuel pump circuit shows current, check the ROUSH CleanTech fuel pump fuse. (See ROUSH CleanTech fuse box for location.) If both fuel pump fuses (OEM and ROUSH CleanTech) are good, go to Step 6.
5	**Check tank solenoid (TS) and supply solenoid (SS) fuses.** a. Locate the TS (E3-E4) and SS (F1-F2) fuses. b. Are the fuses blown?	**Yes** — Find and repair the short; replace the fuse. **No** — Go to Step 8.
6	**Verify that there is power and ground in the wiring circuit to the tank.** a. Check for +12 volts at the fuel pump 1 (FP1) and fuel pump 2 (FP2) connectors. Refer to the *Fuel Rail Pressure Control Module Electrical Check* procedure. b. Is +12 volts present at the FP1 connector? c. Is +12 volts present at the FP2 connector?	**Yes** — Refer to *Engine Stumble, Stall, Rough Idle* Step 9. **No** — Check for an open/short in the wiring circuit and repair.
7	**Integrated Pressure Temperature Sensor Rationality** Does temperature and pressure make sense to verification? See the *Integrated Pressure Temperature Sensor Electrical Check* procedure.	**Yes** — Go to Step 8. **No** — Verify that wiring in circuit is OK. If not, repair wiring. If OK, replace sensor.
8	Refer to the appropriate *Ford Powertrain Control/Emissions Diagnosis Service Manual* at www.motorcraft.com.	—

Fuel Level Indication Check

The ROUSH CleanTech fuel level indication system differs from the gasoline system as the fuel level sender is not wired directly to the instrument cluster. Instead, the fuel level sender is wired to the SRM, which reads the fuel level and transmits the signal to the PCM via the CAN bus, and to the FLIM, which in turn simulates the resistance the instrument cluster expects to see for a given fuel level.

NOTE

The gauge on the sending unit must not be used for any diagnostics. The gauge is not accurate. Only resistance or voltage outputs should be used for diagnostic purposes.

Symptom	Cause/Action to be taken
Fuel gauge does not move on a partial fill	This behavior is not uncommon. The fuel level sender may not move far enough to trigger movement on the gauge if only a small amount of fuel is added to the tank. Once driven, the gauge may move to reflect the fill.
Malfunction Indicator Lamp (MIL)	There is a circuit fault that has been identified by the PCM. Initially follow the *Ford Powertrain Control/Emissions Diagnosis Service Manual,* whenever a circuit check is called for, refer to the *Fuel Level Interface Module Electrical Test* procedure.
Gauge points below E	This is an indication of an error state. Initially follow the *Ford Powertrain Control/Emissions Diagnosis Service Manual*, whenever a circuit check is called for, refer to the *Fuel Level Interface Module Electrical Test* procedure.
Doesn't read full after a fill	This could be the result of either a fuel level sender fault or an OPD valve triggering prematurely. Refer to fill issues and the *Fuel Level Sender Electrical Check* procedure for more information.

Tank Solenoid Electrical Check

NOTE

For harness and connector layout diagrams and system electrical schematics, refer to *System Wiring Diagrams* and to *System Electrical Schematics*.

CONNECTORS

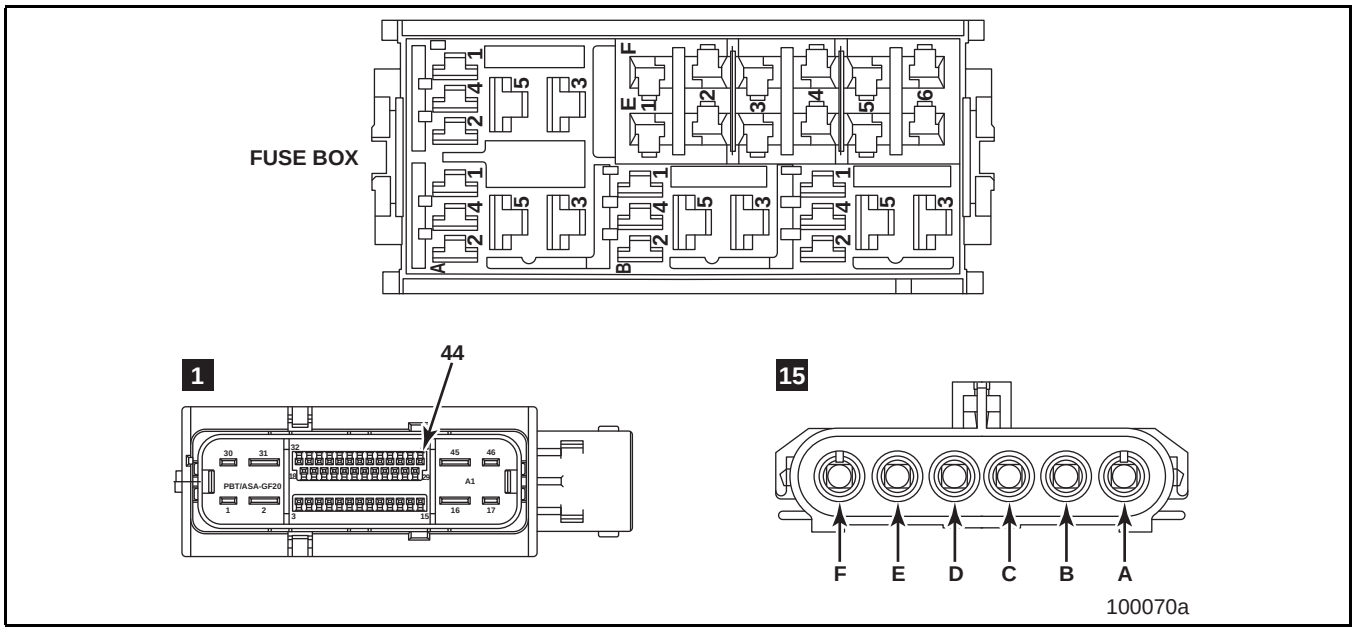


Figure 1 — Underhood Harness Connectors

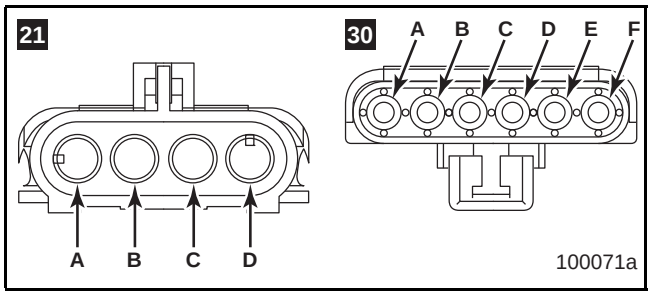


Figure 2 — Rear Frame Harness Connectors

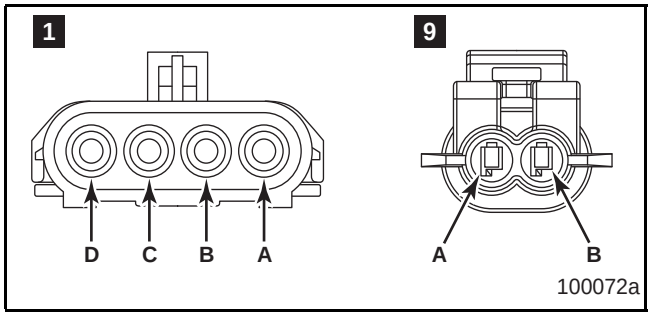


Figure 3 — Solenoid Harness Connectors

PROCEDURE

Step	Procedure	Action
1	**Unplug the solenoid harness connector 9 from the tank solenoid.**	Go to Step 2.
2	**Using a multimeter, measure resistance of the solenoid.** Is the measured resistance within 6–35 ohms?	**Yes** — Go to Step 3. **No** — Replace the tank solenoid.
3	**Using a multimeter, measure voltage at the tank solenoid as follows:** a. With the ignition key on, check for voltage present at pin-A, connector 9 (solenoid harness). Use the body as the reference ground. b. Is battery (B+) voltage present?	**Yes** — Supply circuit OK. **No** — Go to Step 4.
4	**Check fuse (E3-E4, 20A) in auxiliary fuse box.** Is fuse blown?	**Yes** — Replace fuse. **No** — Fuse OK; go to Step 5.
5	**Check relay.** Is relay functioning properly?	**Yes** — Go to Step 6. **No** — Replace relay.
6	**Check supply circuit continuity from solenoid harness to fuse box.** a. Check continuity between: • Pin-A, connector 9 and pin-A, connector 1 (solenoid harness) • Pin-A, connector 21 and pin-A, connector 30 (rear wiring harness) • Pin-A, connector 15 and cavity A5, fuse box (underhood harness) b. Is there good continuity in the circuit?	**Yes** — Go to Step 7. **No** — Repair supply circuit wiring.
7	**Check ground circuit continuity from solenoid harness to smart relay module (SRM) connector.** a. Check continuity between: • Pin-B, connector 9 and pin-B, connector 1 (solenoid harness) • Pin-B, connector 21 and pin-E, connector 30 (rear wiring harness) • Pin-E, connector 15 and pin-44, connector 1 (underhood harness) b. Is there good continuity in the circuit?	**Yes** — Refer to the *Smart Relay Module Electrical Test* procedure. **No** — Repair ground circuit wiring.

Fuel Rail Pressure Control Module Electrical Check

NOTE

For harness and connector layout diagrams and system electrical schematics, refer to *System Wiring Diagrams* and to *System Electrical Schematics*.

CONNECTORS

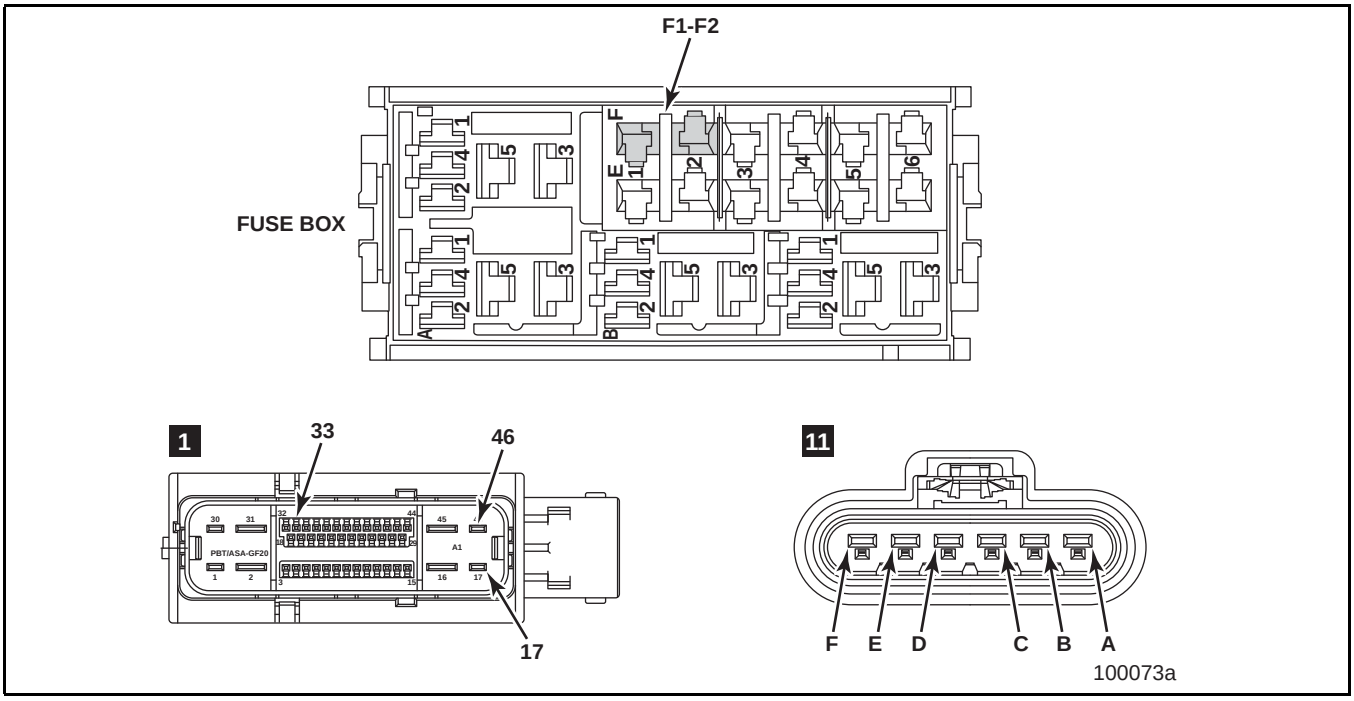


Figure 4 — Underhood Harness Connectors

PROCEDURE

Step	Procedure	Action
1	**Unplug the fuel rail pressure control module (FRPCM) connector from connector 11 of underhood harness.**	Go to Step 2.
2	**Using a multimeter, check the resistance of each solenoid.** a. Check resistance across the terminals of the FRPCM connector in sequence as follows: • Supply Solenoid — Pin-A and pin-F • Flow Control Solenoid — Pin-B and pin-E • Bleed Solenoid — Pin-C and pin-D b. Is the measured resistance for each solenoid within 6–35 ohms?	**Yes** — Go to Step 3. **No** — Replace the FRPCM if resistance for any one of the solenoids is not within the specified range.
3	**Check supply voltage to FRPCM solenoids.** Using a multimeter, measure voltage between the terminal for each solenoid at the harness side connector 11 and ground as follows:	Go to Steps 4–6.

4	**Supply Solenoid** — Pin-A and body ground	**B+ Voltage** — Go to Step 5. **No Voltage** — Go to Step 5.
5	**Flow Control Solenoid** — Pin-B and body ground	**B+ Voltage** — Go to Step 6. **No Voltage** — Go to Step 6 if Step 4 has voltage; if Step 4 has no voltage, go to Step 7.
6	**Bleed Solenoid** — Pin-C and body ground	**B+ Voltage** — Continue with Step 9. **No Voltage** — Go to Step 8 if Step 4 has voltage; if Step 4 has no voltage, go to Step 7.
7	**Check fuses (F1-F2, 10A) in auxiliary fuse box.** Is a fuse blown?	**Yes** — Replace fuse. **No** — Go to Step 8.
8	**Check solenoid supply circuit continuity.** a. Check continuity between: • Supply Solenoid — Pin-A, connector 11 (underhood harness) and cavity F2 (auxiliary fuse box) • Flow Control Solenoid — Pin-B, connector 11 (underhood harness) and cavity F2 (auxiliary fuse box) • Bleed Solenoid — Pin-C, connector 11 (underhood harness) and cavity F2 (auxiliary fuse box) b. Is there good continuity in all three circuits?	**Yes** — Go to Step 9. **No** — Repair wiring circuit.
9	**Check solenoid ground circuit continuity.** a. Check continuity in the underhood harness between: • Supply Solenoid — Pin-F, connector 11 and pin-46, connector 1 at SRM • Flow Control Solenoid — Pin-E, connector 11 and pin-33, connector 1 at SRM • Bleed Solenoid — Pin-D, connector 11 and pin-17, connector 1 at SRM b. Is there good continuity in all three circuits?	**Yes** — Refer to the *Smart Relay Module Electrical Test* procedure. **No** — Repair wiring circuit.

Integrated Pressure Temperature Sensor Electrical Check

NOTE

For harness and connector layout diagrams and system electrical schematics, refer to *System Wiring Diagrams* and to *System Electrical Schematics*.

CONNECTORS

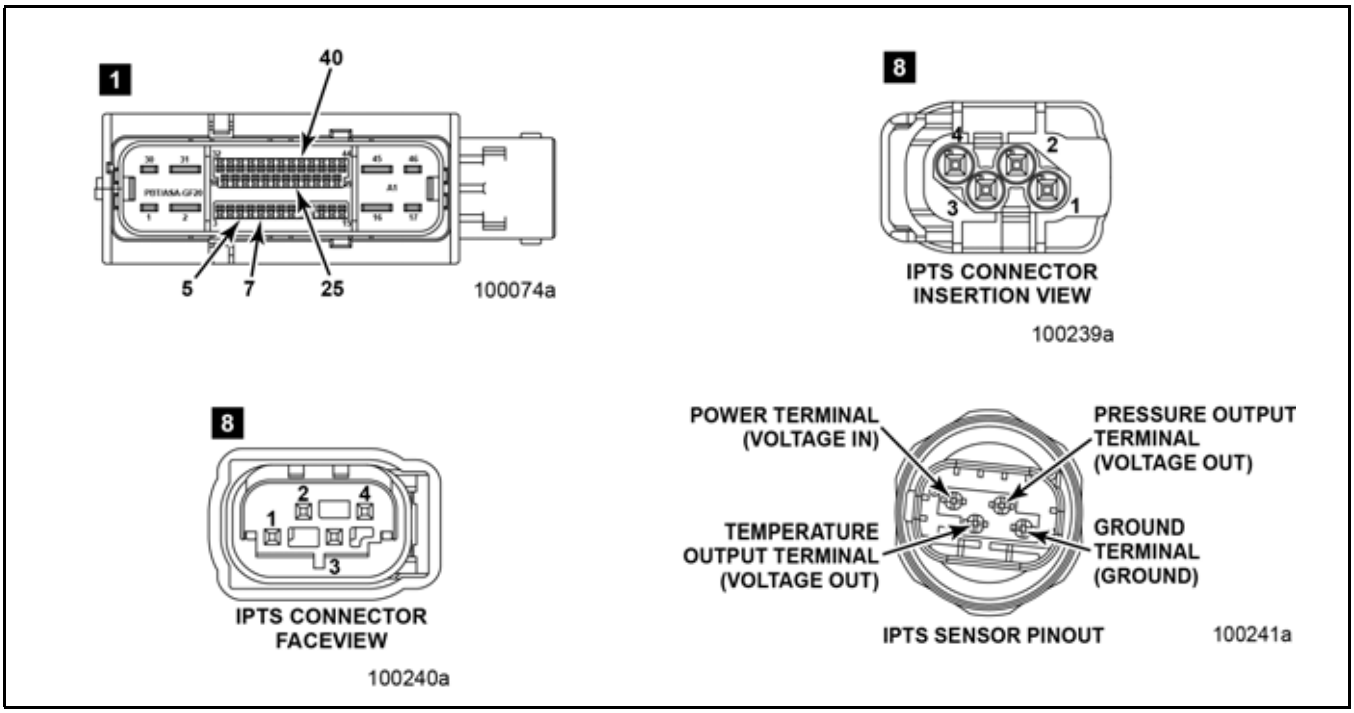


Figure 5 — Underhood Harness Connectors

PROCEDURE

Step	Procedure	Action
1	**Unplug the connector 8 (underhood harness) to the IPTS.**	Go to Step 2.
2	**Check resistance of the integrated pressure temperature sensor (IPTS).** a. With vehicle at ambient room temperature (20–30°C, 68–86°F) and using a multimeter, measure resistance across the IPTS terminals (between pin-1 and pin-3). b. Is the resistance value between 8K–12K ohms?	**Yes** — Go to Step 3. **No** — Replace the IPTS.

Step	Procedure	Action
3	**Check circuit continuity between the IPTS and the smart relay module (SRM).** a. Using a multimeter, check continuity in the underhood harness between: • Pin-1, connector 8 and pin-40, connector 1 • Pin-2, connector 8 and pin-7, connector 1 • Pin-3, connector 8 and pin-5, connector 1 • Pin-4, connector 8 and pin-25, connector 1 b. Is there good continuity in the circuits?	**Yes** — Refer to the *Smart Relay Module Electrical Test* procedure. **No** — Repair circuit wiring.

Fuel Pump Electrical Test

NOTE

For harness and connector layout diagrams and system electrical schematics, refer to *System Wiring Diagrams* and to *System Electrical Schematics*.

CONNECTORS

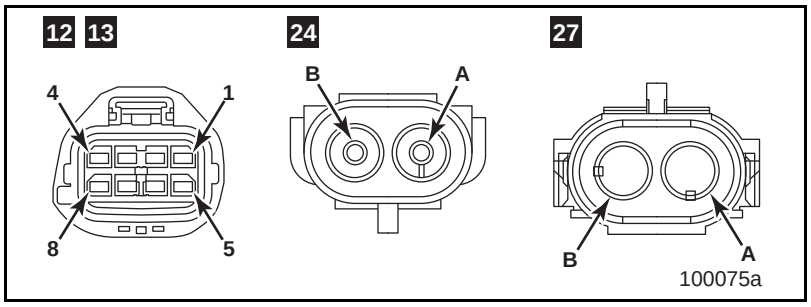


Figure 6 — Rear Frame Harness Connectors

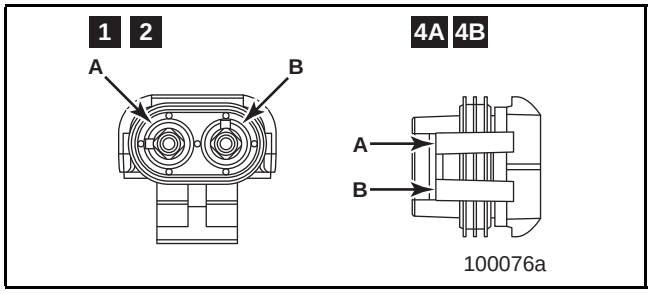


Figure 7 — In-Tank Harness Connectors

PROCEDURE

Step	Procedure	Action
1	**Check fuel pump circuit continuity.** a. Unplug the FPCM connector 12 for fuel pump 1. Check fuel pump circuit continuity. b. Using a multimeter, measure resistance between pin-5 and pin-8. c. Is resistance between 0.4–1.0 ohm?	**Yes** — Go to Step 2. **No** — Go to Step 3.
2	**Check fuel pump circuit continuity.** a. Unplug the FPCM connector 13 for fuel pump 2. b. Using a multimeter, measure resistance between pin-5 and pin-8. c. Is resistance between 0.4–1.0 ohm?	**Yes** — Refer to the *Fuel Pump Control Module Electrical Continuity Test* procedure. **No** — Go to Step 3.
3	**Check resistance of each fuel pump.** a. Unplug the fuel pump connectors (in-tank harness) at the fuel pump assembly. b. Using a multimeter, measure resistance for fuel pump 1 across the terminals of the fuel pump. c. Is resistance between 0.4–1.0 ohm?	**Yes** — Go to Step 4. **No** — Replace fuel pump assembly.

Step	Procedure	Action
4	**Check resistance continued.** a. Using a multimeter, measure resistance for fuel pump 2 across the terminals of the fuel pump. b. Is resistance between 0.4–1.0 ohm?	**Yes** — Go to Step 5. **No** — Replace fuel pump assembly.
5	**Check harness circuit continuity from fuel pumps to FPCM.** a. Check continuity for pump 1, wire FPPWR, V+ across: • Pin-A, connector 4A (in-tank harness) to pin-A, connector 1 (in-tank harness) • Pin-A, connector 24 (rear frame harness) and pin-5, connector 12 (rear frame harness) b. Check continuity for pump 1, wire FPRTN, V– across: • Pin-B, connector 4A (in-tank harness) to pin-B, connector 1 (in-tank harness) • Pin-B, connector 24 (rear frame harness) and pin-8, connector 12 (rear frame harness) c. Check continuity for pump 2, wire FPPWR, V+ across: • Pin-A, connector 4B (in-tank harness) to pin-A, connector 2 (in-tank harness) • Pin-A, connector 27 (rear harness) and pin-5, connector 13 (rear harness) d. Check continuity for pump 2, wire FPRTN, V– across: • Pin-B, connector 4B (in-tank harness) to pin-B, connector 2 (in-tank harness) • Pin-B, connector 27 (rear frame harness) and pin-8, connector 13 (rear frame harness) e. Is there good continuity in all circuits?	**Yes** — Refer to the *Fuel Pump Control Module Electrical Continuity Test* procedure. **No** — Repair circuit wiring.

Fuel Pump Control Module Electrical Continuity Test

NOTE

For harness and connector layout diagrams and system electrical schematics, refer to *System Wiring Diagrams* and to *System Electrical Schematics*.

CONNECTORS

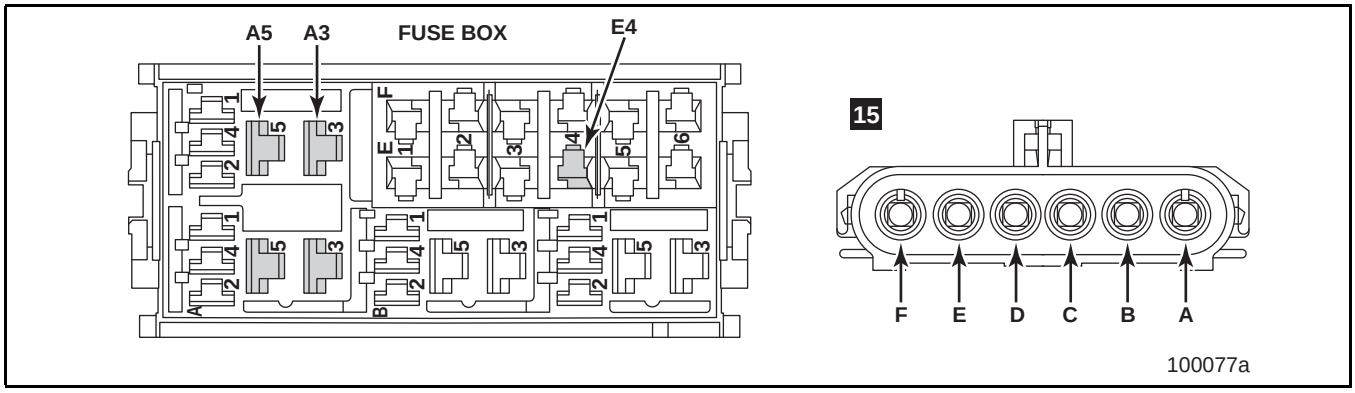


Figure 8 — Underhood Harness Connectors

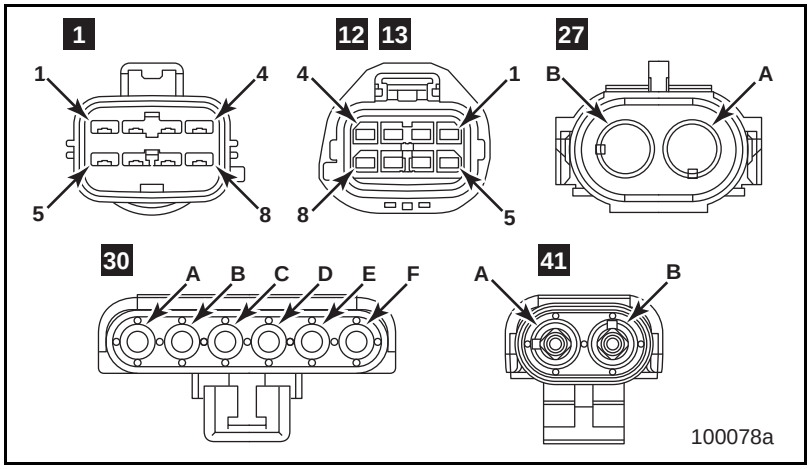


Figure 9 — Rear Frame Harness Connectors

PROCEDURE

Step	Procedure	Action
	For fuel pump control module (FPCM) functional testing and diagnostic trouble codes, refer to the *Ford Powertrain Control/Emissions Diagnosis Service Manual* at www.motorcraft.com.	
1	**Check Ford FPCM circuit continuity to Ford harness.** a. Disconnect rear frame harness connectors 1 and 12. b. Check for continuity in the rear frame harness across: • Pin-1, connector 1 and pin-1, connector 12 • Pin-3, connector 1 and pin-3, connector 12 • Pin-4, connector 1 and pin-4, connector 12 • Pin-5, connector 1 and pin-5, connector 12 • Pin-6, connector 1 and pin-6, connector 12 • Pin-7, connector 1 and pin-7, connector 12 c. Is there good continuity in each circuit?	**Yes** — Go to Step 2. **No** — Repair circuit wiring.
2	**Check FPCM circuit continuity to Ford harness.** a. Disconnect rear frame harness connector 13. b. Check wire VPWR (V+) for continuity across: • Pin-1, connector 13 (rear frame harness) and pin-A, connector 30 (rear frame harness) • Pin-A, connector 15 (underhood harness) and cavity-A5, fuse box (underhood harness) • Cavity-A3, fuse box (underhood harness) and cavity-E4, fuse box (underhood harness) c. Is there good continuity in each circuit?	**Yes** — Go to Step 3. **No** — Repair circuit wiring.
3	**Check fuse condition (E3-E4).** Is the fuse blown?	**Yes** — Replace the fuse. **No** — Go to Step 4.
4	**Check Roush CleanTech FPCM circuit continuity to Ford harness.** a. Check for continuity in the rear frame harness across: • Pin-A, connector 30 and pin-1, connector 13 • Pin-4, connector 1 and pin-4, connector 13 • Pin-A, connector 27 and pin-5, connector 13 • Pin-6, connector 1 and pin-6, connector 13 • Pin-B, connector 27 and pin-8, connector 13 • Pin-A, connector 41 and pin-7, connector 13 b. Is there good continuity in each circuit?	**Yes** — Refer to the *Ford Powertrain Control/Emissions Diagnosis Service Manual* for functional testing of the FPCM. **No** — Repair circuit wiring.

Smart Relay Module Electrical Test

NOTE

For harness and connector layout diagrams and system electrical schematics, refer to *System Wiring Diagrams* and to *System Electrical Schematics*.

CONNECTORS

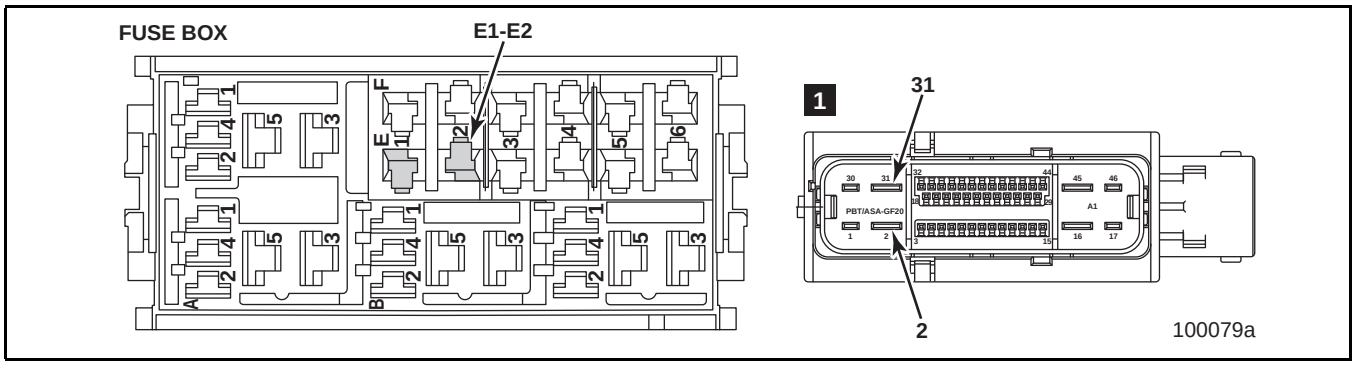


Figure 10 — Underhood Harness Connectors

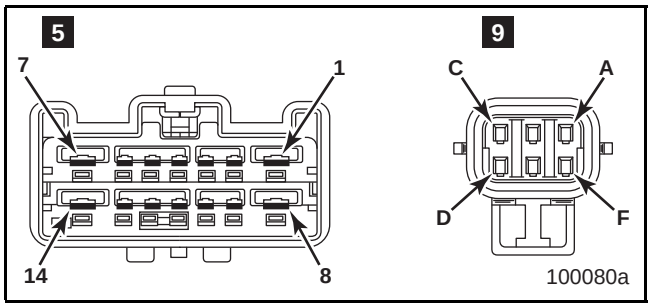


Figure 11 — CAN Harness Connectors

PROCEDURE

Step	Procedure	Action
1	**Disconnect the smart relay module (SRM) connector 1 (underhood harness).**	Go to Step 2.
2	**Check for battery voltage (B+) to the SRM.** a. Using a multimeter, check for B+ voltage at cavity 2, connector 1. Use a body ground for reference. b. Is there voltage (B+)?	**Yes** — Go to Step 5. **No** — Go to Step 3.
3	**Check for battery voltage (B+) to the SRM.** a. Check circuit continuity between cavity 2, connector 1 and cavity E2, auxiliary fuse box. b. Is there good continuity in the circuit?	**Yes** — Go to Step 4. **No** — Repair circuit wiring.

Step	Procedure	Action
4	**Check for battery voltage (B+) to the SRM.** a. Check condition of SRM power fuse (E1-E2, 25A) in the auxiliary fuse box. b. Is fuse blown?	**Yes** — Replace fuse. **No** — Go to Step 5.
5	**Check the SRM ground circuit for continuity.** a. Using a multimeter, check ground at cavity 31, connector 1 (underhood harness). Use a body ground for reference. b. Is there good continuity?	**Yes** — Go to Step 6. **No** — Repair circuit wiring.
6	**Check for active signal to SRM.** a. Using a multimeter, check the underhood harness for continuity in the E-Series system between pin-26, connector 1 and pin-A, connector 23 and in F-Series system between pin-26, connector 1 and pin-1, connector 51/55. b. Is there good continuity in the circuit?	**Yes** — E-Series: Go to Step 8, F-Series: Go to Step 9. **No** — Go to Step 7.
7	**Check fuse.** a. Check condition of fuse (F5-F6, 5A) in auxiliary fuse box. b. Is fuse blown?	**Yes** — Replace fuse. **No** — Repair circuit wiring
8	**E-Series Only: Check CAN harness for SRM circuit continuity.** a. Check continuity between pin-A, connector 9 and pin-12, connector 5. b. Is there good continuity in the circuit?	**Yes** — Go to Step 9. **No** — Repair circuit wiring.
9	**Check CAN and underhood harness continuity.** a. Check CAN-H(+) continuity across: • Pin-28, SRM connector 1 (underhood harness) and pin-C, connector 23 (underhood harness) • Pin-C, connector 9 (CAN harness) and pin-2, connector 5 (CAN harness) b. Is there good continuity in the circuits?	**Yes** — Go to Step 10. **No** — Repair circuit wiring.
10	**Check CAN and underhood harness continuity.** a. Check CAN-H(–) continuity across: • Pin-43, SRM connector 1 (underhood harness) and pin-B, connector 23 (underhood harness) • Pin-B, connector 9 (CAN harness) and pin-3, connector 5 (CAN harness) b. Is there good continuity in the circuits?	**Yes** — Refer to the *Ford Powertrain Control/Emissions Diagnosis Service Manual* for functional testing of the CAN bus. **No** — Repair circuit wiring.

Fuel Level Sender Electrical Check

NOTE

For harness and connector layout diagrams and system electrical schematics, refer to *System Wiring Diagrams* and to *System Electrical Schematics*.

CONNECTORS

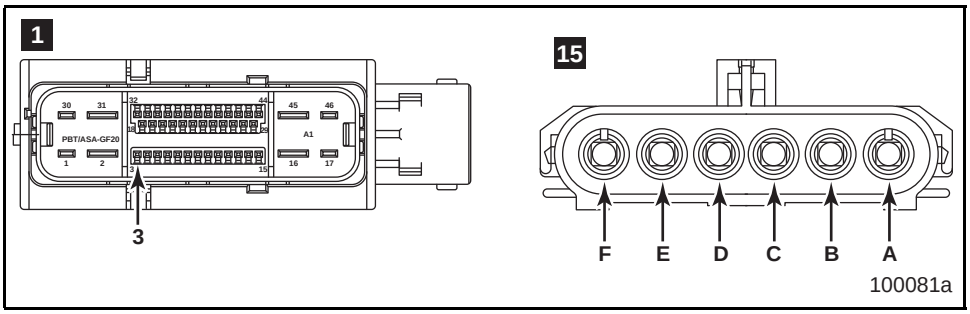


Figure 12 — Underhood Harness Connectors

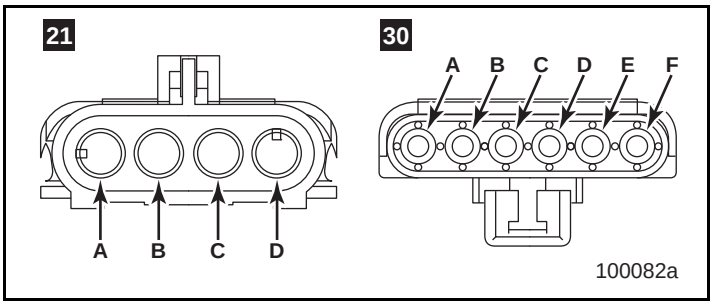


Figure 13 — Rear Frame Harness Connectors

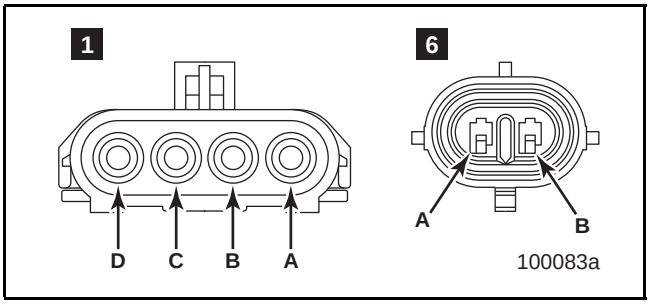


Figure 14 — Solenoid Harness Connectors

PROCEDURE

Step	Procedure	Action
	For fuel level sender (FLS) functional testing and diagnostic trouble codes, use *Diagnostic Tests and Procedures* and *Diagnostic Trouble Codes*.	
1	**Check resistance in FLS circuit wiring.** a. Disconnect the SRM connector 1 (underhood harness). b. Using a multimeter, measure the resistance between pin-3 and pin-40 of the harness connector. c. Is resistance between 24–260 ohms?	**Yes** — Refer to the *Smart Relay Module Electrical Test* procedure or the *Fuel Level Interface Module Electrical Test* procedure. **No** — Go to Step 2.
2	**Check resistance of the FLS.** a. Disconnect the FLS connector 6 (solenoid harness). b. Using a multimeter, measure the resistance across the FLS connector pins. c. Is resistance between 24–260 ohms?	**Yes** — Go to Step 3. **No** — Replace the FLS.
3	**Check circuit wiring continuity between FLS connector and SRM connector.** a. Disconnect connector 1 of the solenoid harness. b. Check continuity between pin-B, connector 6 (solenoid harness) and pin-C, connector 1 (solenoid harness). c. Is there good continuity in the circuit?	**Yes** — Go to Step 4. **No** — Repair circuit wiring.
4	**Check circuit wiring continuity between FLS connector and SRM connector.** a. Disconnect connector 30 of the rear frame harness. b. Check continuity between pin-C, connector 21 (rear frame harness) and pin-D, connector 30 (rear frame harness). c. Is there good continuity in the circuit?	**Yes** — Go to Step 5. **No** — Repair circuit wiring.
5	**Check circuit wiring continuity between FLS connector and SRM connector.** a. With SRM connector 1 and connector 15 of the underhood harness disconnected, check continuity between pin-C, connector 15 and pin-3, SRM connector 1. b. Is there good continuity in the circuit?	**Yes** — Go to Step 6. **No** — Repair circuit wiring.
6	**Check circuit wiring continuity between FLS connector and SRM connector.** a. Check continuity between pin-A, connector 6 (solenoid harness) and pin-D, connector 1 (solenoid harness). b. Is there good continuity in the circuit?	**Yes** — Go to 7. **No** — Repair circuit wiring.
7	**Check circuit wiring continuity between FLS connector and SRM connector.** a. Check continuity between pin-D, connector 21 (rear frame harness) and pin-C, connector 30 (rear frame harness). b. Is there good continuity in the circuit?	**Yes** — Go to Step 8. **No** — Repair circuit wiring.
8	**Check circuit wiring continuity between FLS connector and SRM connector.** a. Check continuity between pin-D, connector 15 (rear frame harness) and pin-40, SRM connector (underhood harness). b. Is there good continuity in the circuit?	**Yes** — Refer to the *Smart Relay Module Electrical Test* procedure or the *Fuel Level Interface Module Electrical Test* procedure. **No** — Repair circuit wiring.

Fuel Level Interface Module Electrical Test

NOTE

For harness and connector layout diagrams and system electrical schematics, refer to *System Wiring Diagrams* and to *System Electrical Schematics*.

CONNECTORS

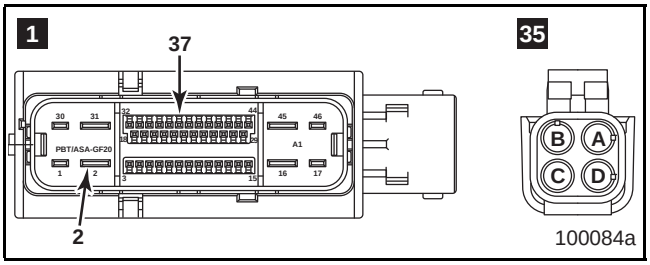


Figure 15 — Underhood Harness Connectors

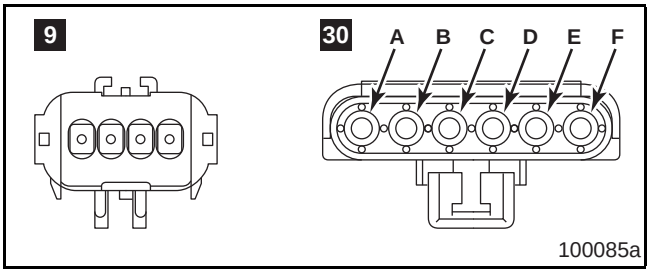


Figure 16 — Rear Frame Harness Connectors

PROCEDURE

Step	Procedure	Action
	For FLIM functional testing and diagnostic trouble codes, use *Diagnostic Tests and Procedures* and *Diagnostic Trouble Codes*.	
1	**Check FLIM circuit wiring for continuity to SRM.** a. Disconnect underhood harness connector 1 to SRM. b. Check underhood harness continuity between pin-A, connector 35 and pin-2, connector 1. c. Is there good continuity in the circuit?	**Yes** — Go to Step 2. **No** — Repair circuit wiring.
2	**Check FLIM circuit wiring for continuity to SRM.** a. Check underhood harness continuity between pin-B, connector 35 and pin-37, connector 1. b. Is there good continuity in the circuit?	**Yes** — Go to Step 3. **No** — Repair circuit wiring.
3	**Check FLIM circuit wiring for continuity to SRM.** a. Check underhood harness continuity between pin-C, connector 35 and body ground. b. Is there good continuity in the circuit?	**Yes** — Go to Step 4. **No** — Repair circuit wiring.
4	**Check FLIM circuit wiring for continuity to SRM.** a. Disconnect underhood harness connector 15 to rear frame harness. b. Check underhood harness continuity between pin-D, connector 35 and pin-F, connector 15. c. Is there good continuity in the circuit?	**Yes** — Go to Step 5. **No** — Repair circuit wiring.

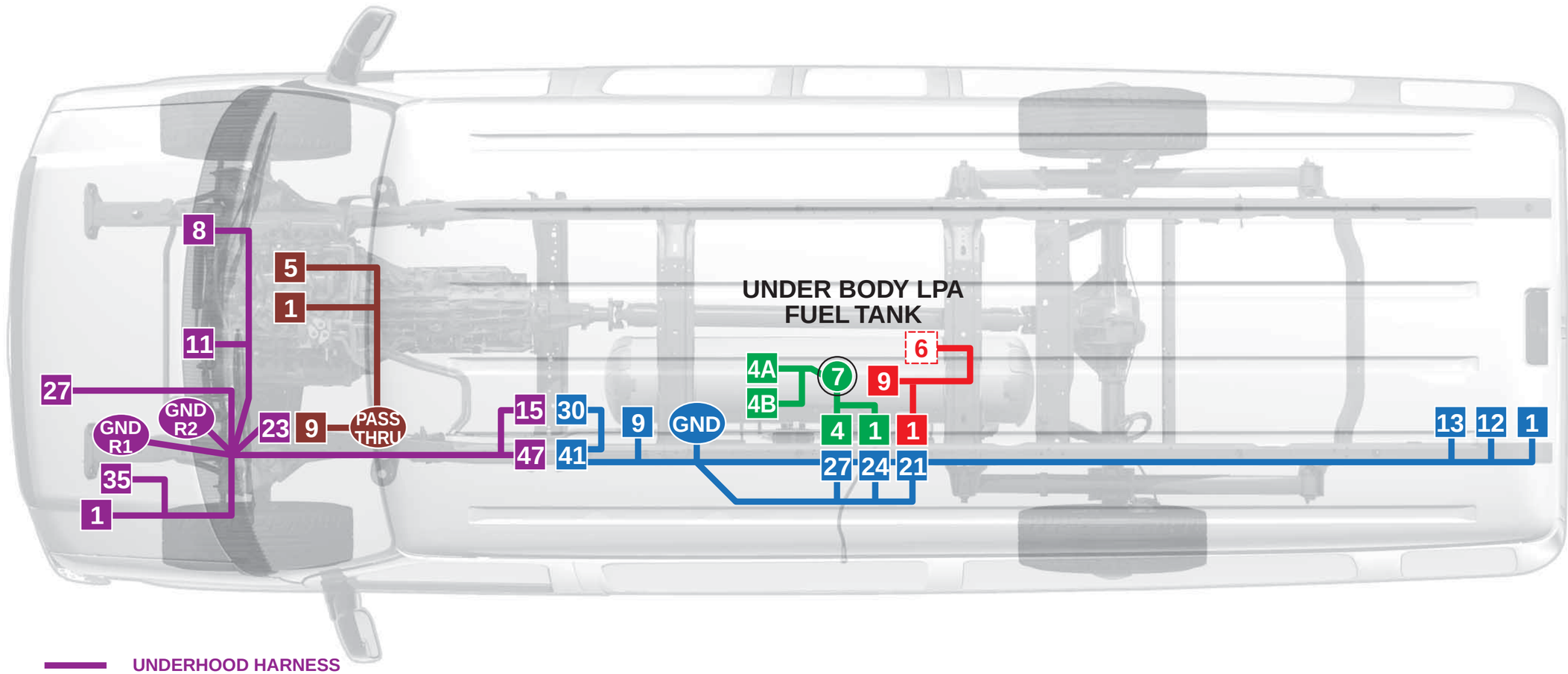
Step	Procedure	Action
5	**Check FLIM circuit wiring for continuity to SRM.** a. Disconnect rear frame harness connector 9 to Ford harness. b. Check rear frame harness continuity between pin-F, connector 30 and pin-2, connector 9. c. Is there good continuity in the circuit?	**Yes** — Refer to the *Smart Relay Module Electrical Test* procedure. **No** — Repair circuit wiring.

WIRING DIAGRAMS AND ELECTRICAL SCHEMATICS

E-150/150/350 Extended Wiring Harnesses and Connector Layout

E-150/250/350 WIRING HARNESSES AND CONNECTOR LAYOUT

APPROXIMATE LOCATION OF LPA SYSTEM HARNESSES AND CONNECTORS

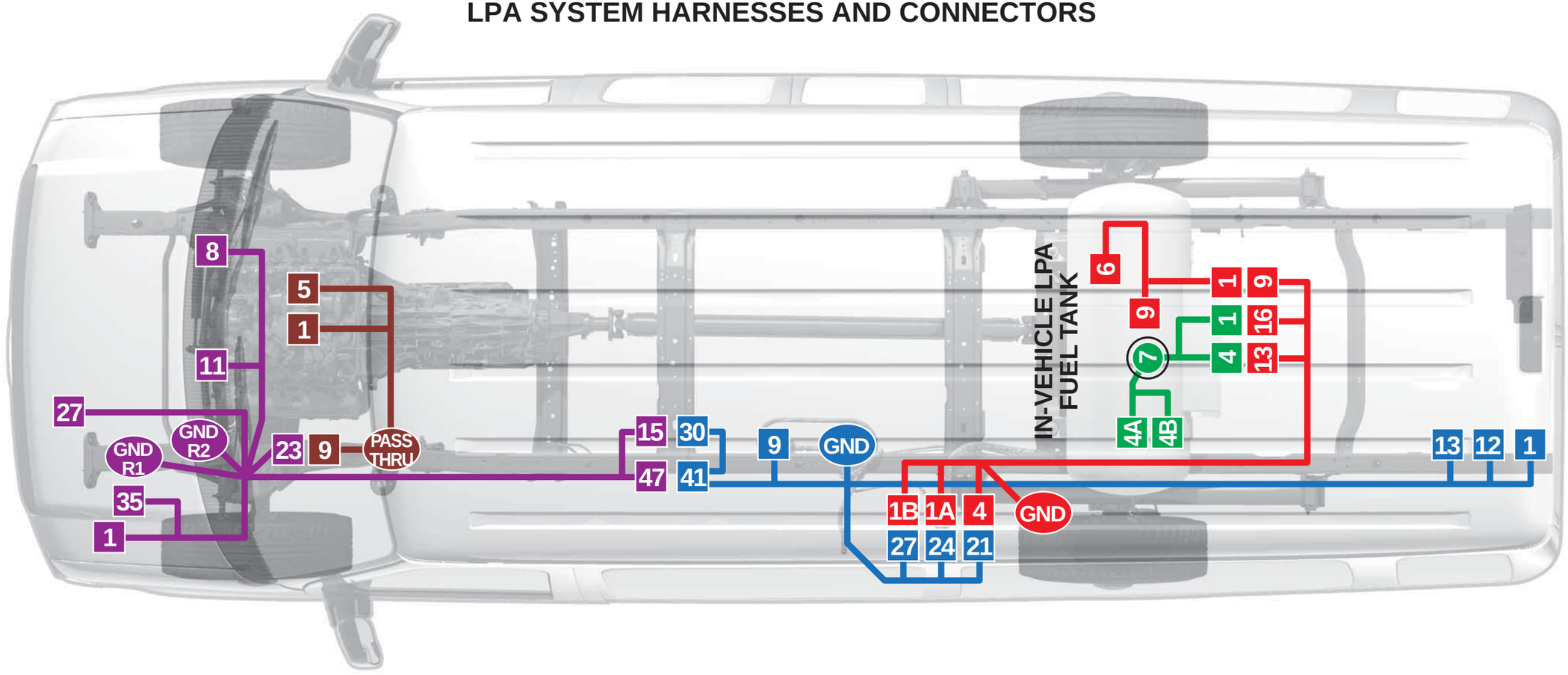


100129a

E-150/250/350 Extended Range Wiring Harnesses and Connector Layout

E-150/250/350 EXTENDED RANGE WIRING HARNESSES AND CONNECTOR LAYOUT

APPROXIMATE LOCATION OF LPA SYSTEM HARNESSES AND CONNECTORS

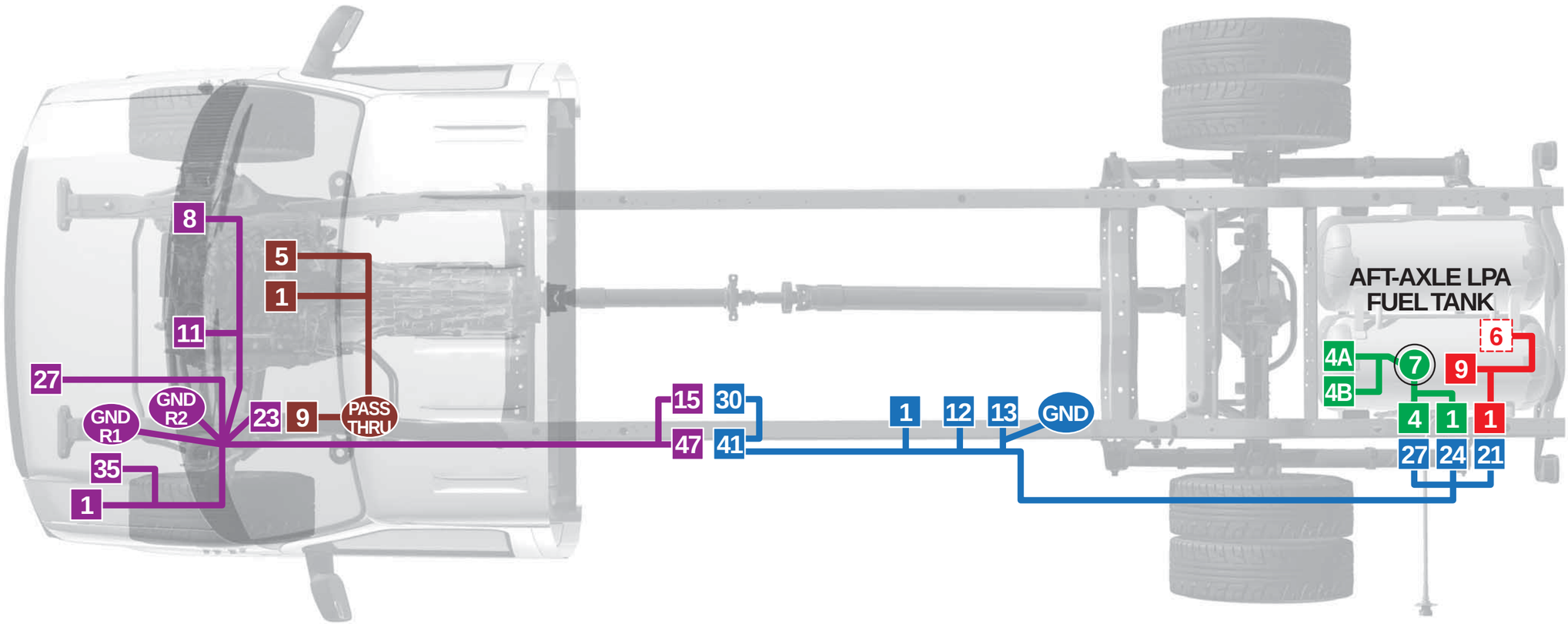


100152a

E-450 Custom Body Wiring Harnesses and Connector Layout

E-450 WIRING HARNESSES AND CONNECTOR LAYOUT

APPROXIMATE LOCATION OF LPA SYSTEM HARNESSES AND CONNECTORS

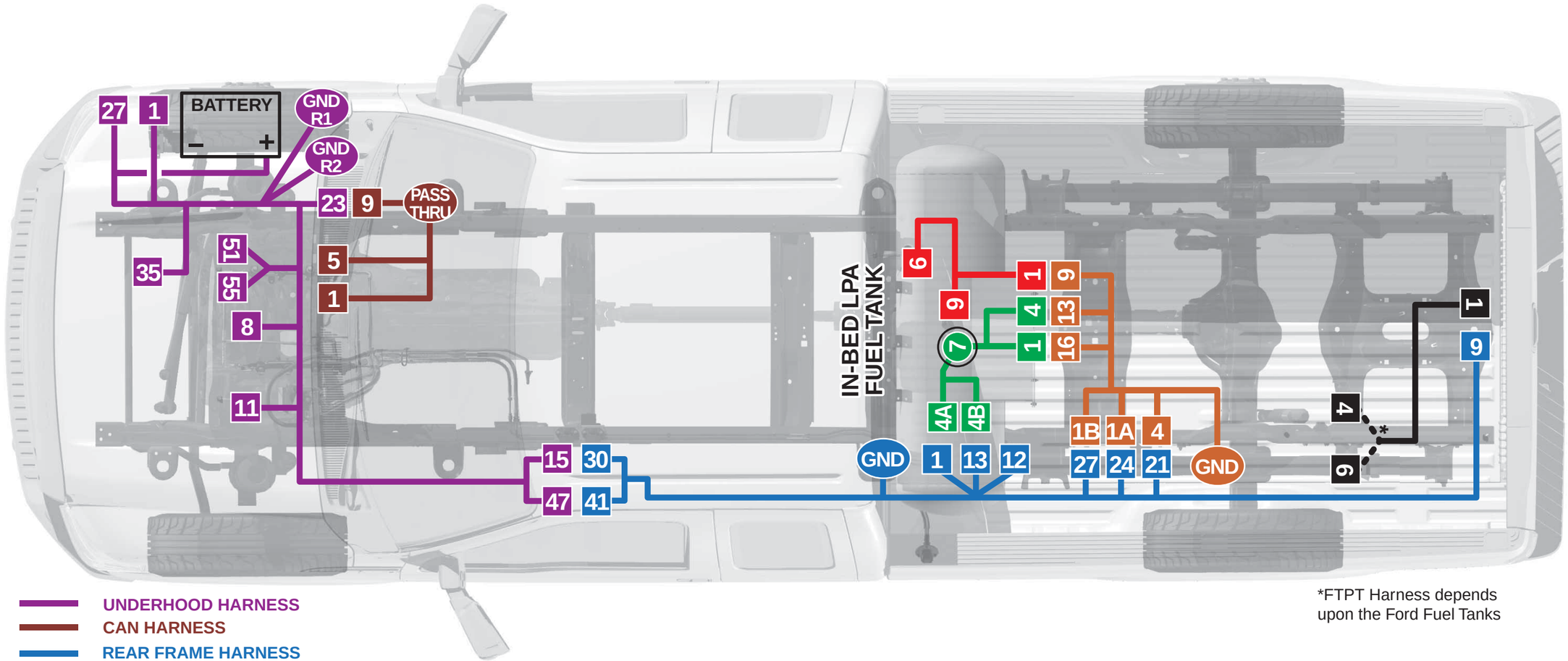


100153a

F-250/350 Pickup, In-Bed Tank Wiring Harnesses and Connector Layout

F-250/350 PICKUP, IN-BED TANK WIRING HARNESSES AND CONNECTOR LAYOUT

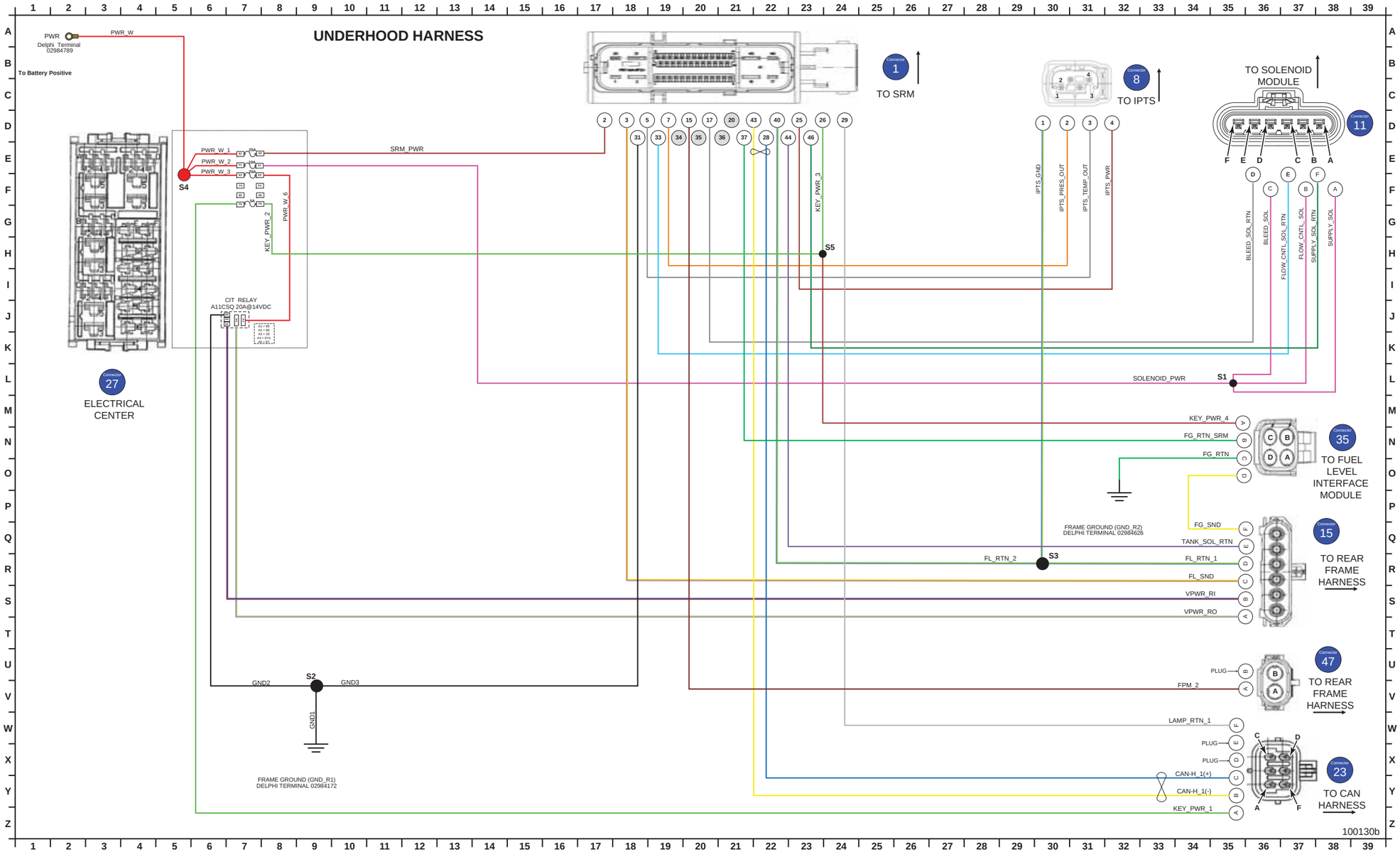
APPROXIMATE LOCATION OF LPA SYSTEM HARNESSES AND CONNECTORS



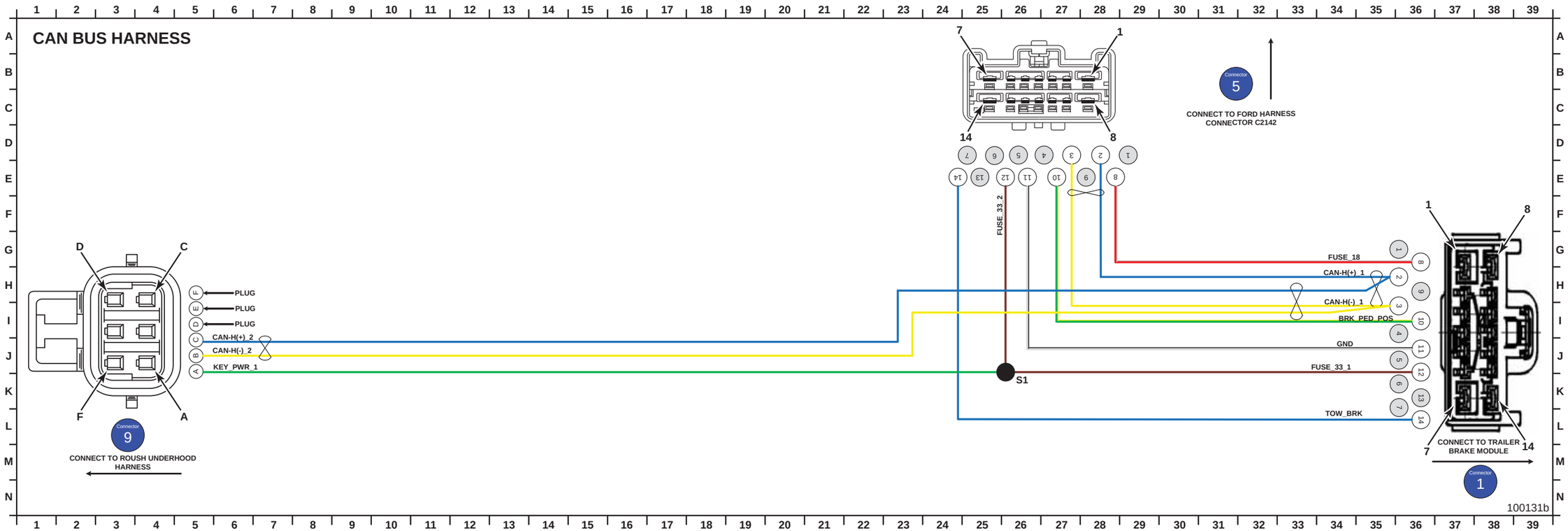
*FTPT Harness depends upon the Ford Fuel Tanks

100187a

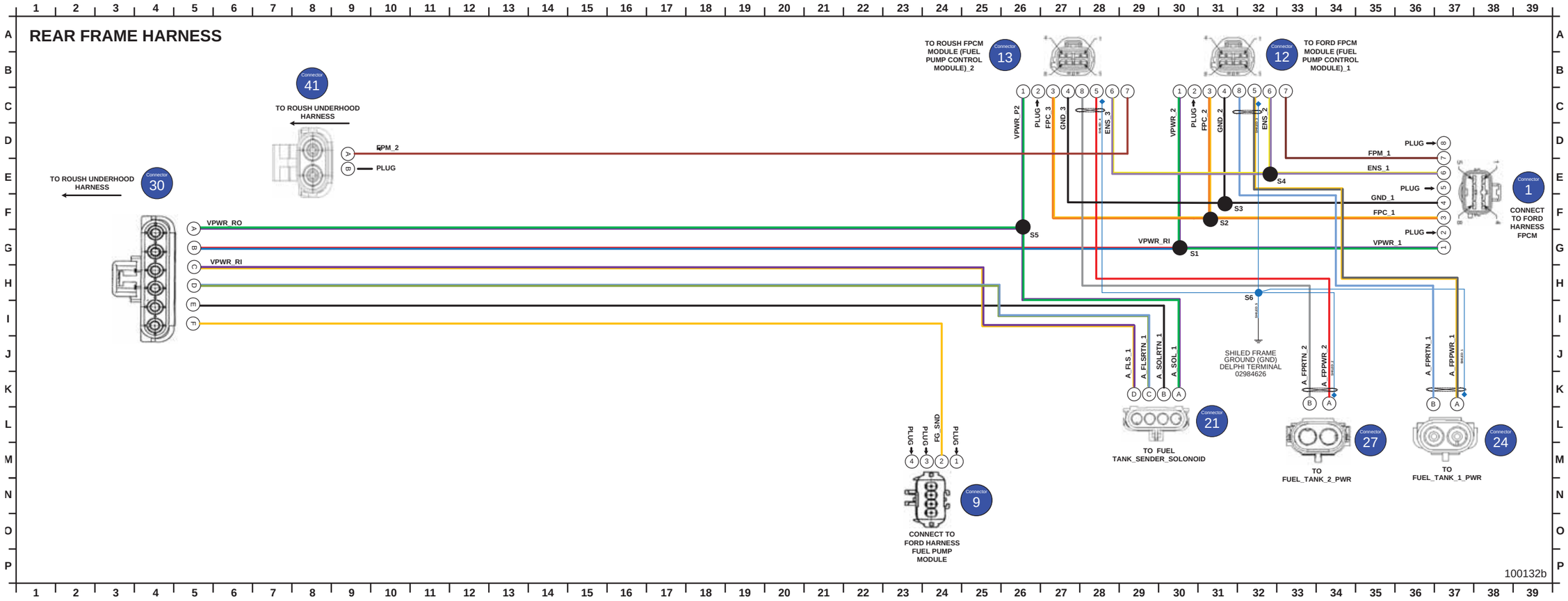
E-Series, Extended Range and E-450 Electrical Schematic — Underhood Harness



E-Series, Extended Range and E-450 Electrical Schematic — CAN Bus Harness

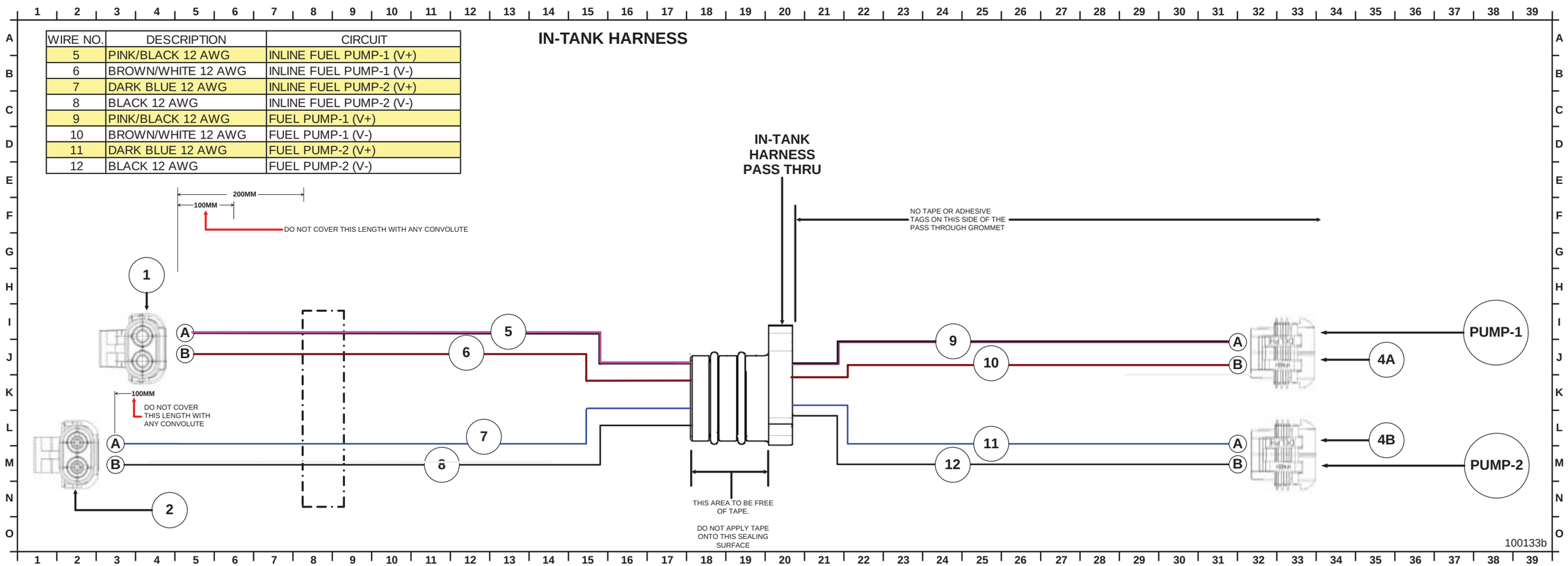


E-Series, Extended Range and E-450 Electrical Schematic — Rear Frame Harness



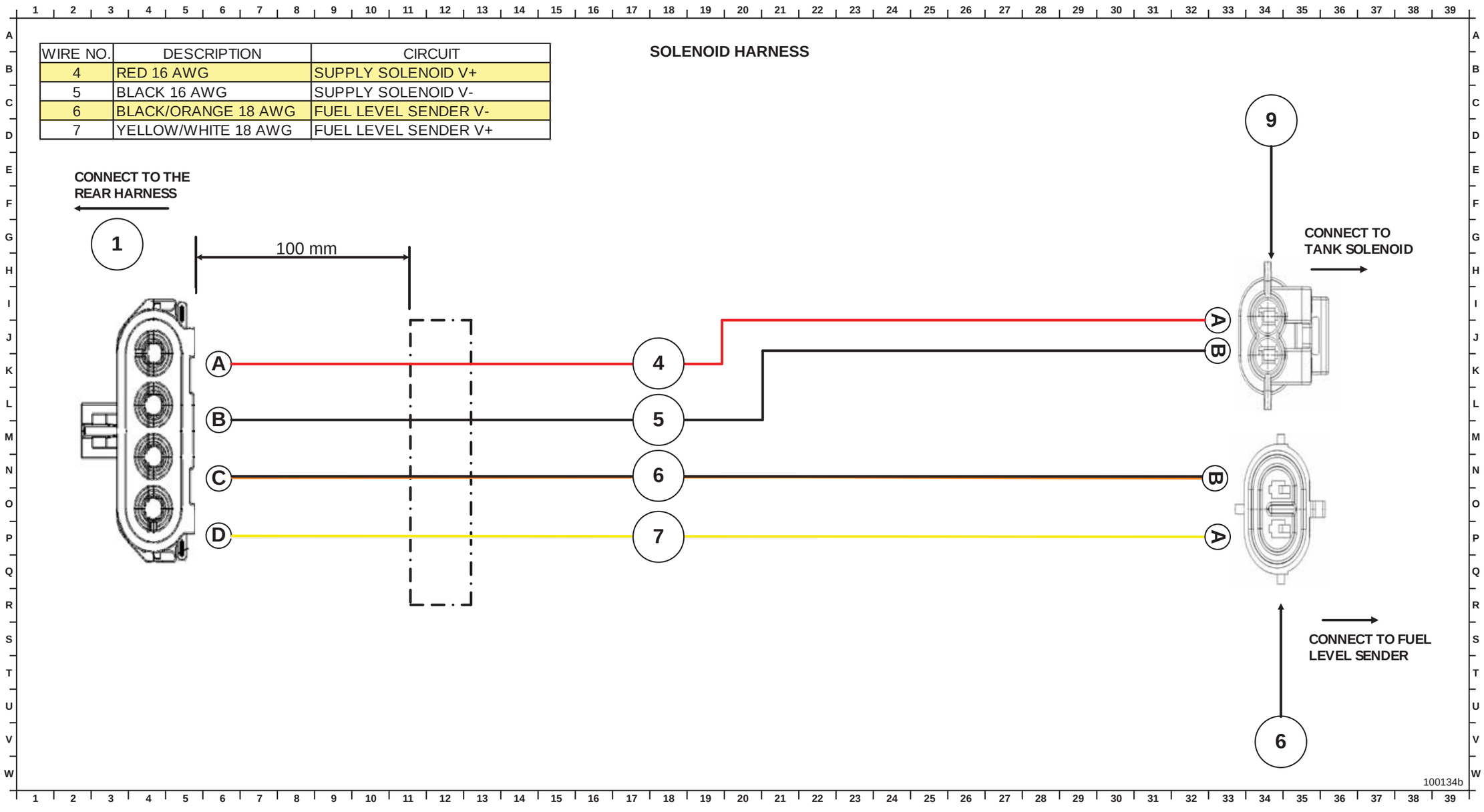
E-Series, Extended Range and E-450 Electrical Schematic — In-Tank Harness

WIRE NO.	DESCRIPTION	CIRCUIT
5	PINK/BLACK 12 AWG	INLINE FUEL PUMP-1 (V+)
6	BROWN/WHITE 12 AWG	INLINE FUEL PUMP-1 (V-)
7	DARK BLUE 12 AWG	INLINE FUEL PUMP-2 (V+)
8	BLACK 12 AWG	INLINE FUEL PUMP-2 (V-)
9	PINK/BLACK 12 AWG	FUEL PUMP-1 (V+)
10	BROWN/WHITE 12 AWG	FUEL PUMP-1 (V-)
11	DARK BLUE 12 AWG	FUEL PUMP-2 (V+)
12	BLACK 12 AWG	FUEL PUMP-2 (V-)

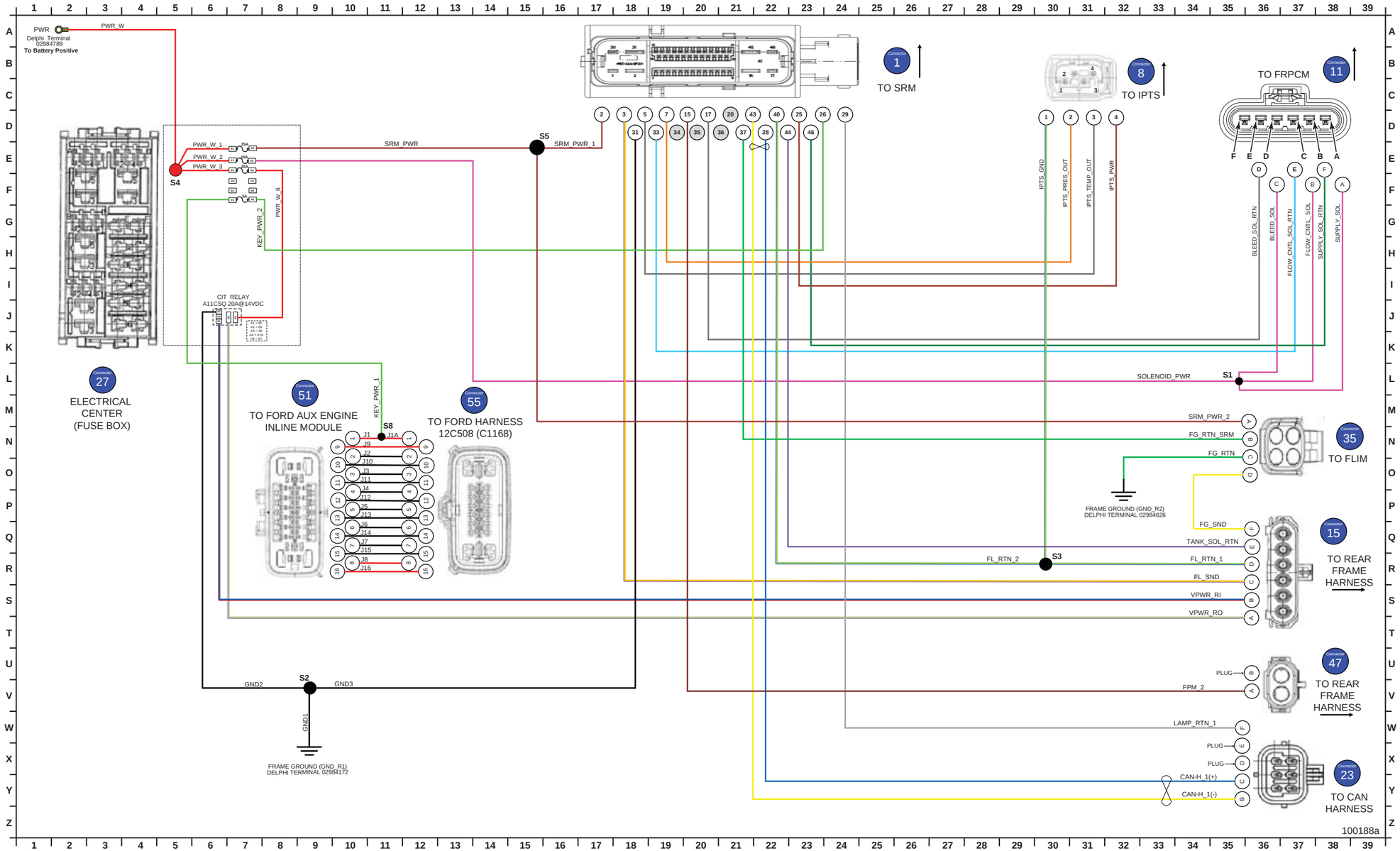

IN-TANK HARNESS
IN-TANK HARNESS PASS THRU
200MM
100MM
DO NOT COVER THIS LENGTH WITH ANY CONVOLUTE
NO TAPE OR ADHESIVE TAGS ON THIS SIDE OF THE PASS THROUGH GROMMET
100MM
DO NOT COVER THIS LENGTH WITH ANY CONVOLUTE
THIS AREA TO BE FREE OF TAPE.
DO NOT APPLY TAPE ONTO THIS SEALING SURFACE
PUMP-1
PUMP-2
100133b

E-Series, Extended Range and E-450 Electrical Schematic — Solenoid Harness

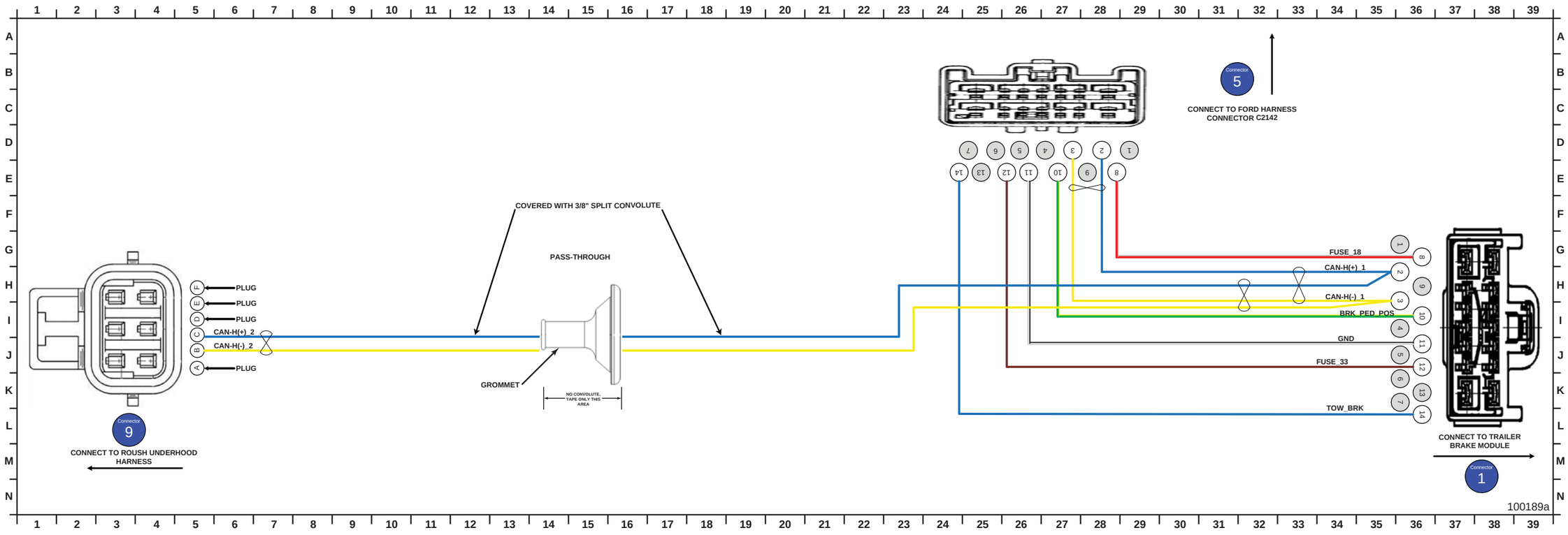
WIRE NO.	DESCRIPTION	CIRCUIT
4	RED 16 AWG	SUPPLY SOLENOID V+
5	BLACK 16 AWG	SUPPLY SOLENOID V-
6	BLACK/ORANGE 18 AWG	FUEL LEVEL SENDER V-
7	YELLOW/WHITE 18 AWG	FUEL LEVEL SENDER V+



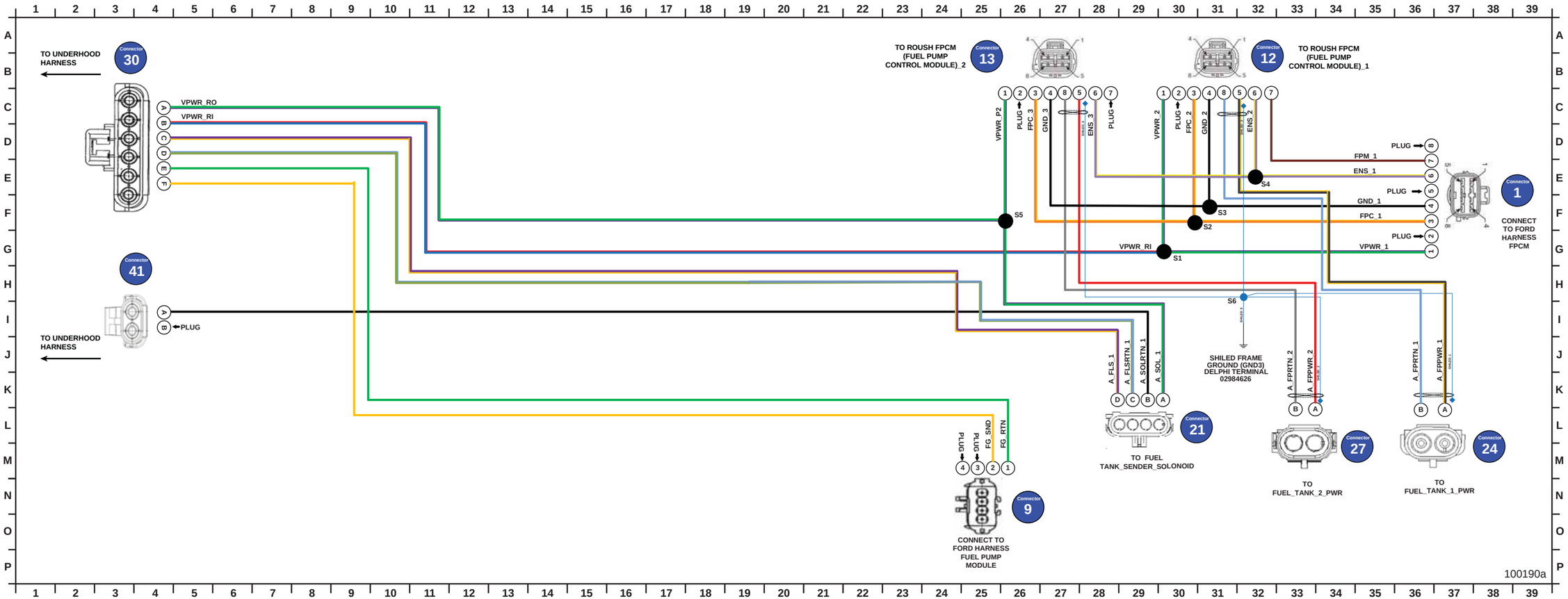
F-250/350 Pickup, Underhood Harness Electrical Schematic



F-250/350 Pickup, CAN Bus Jumper Harness Electrical Schematic

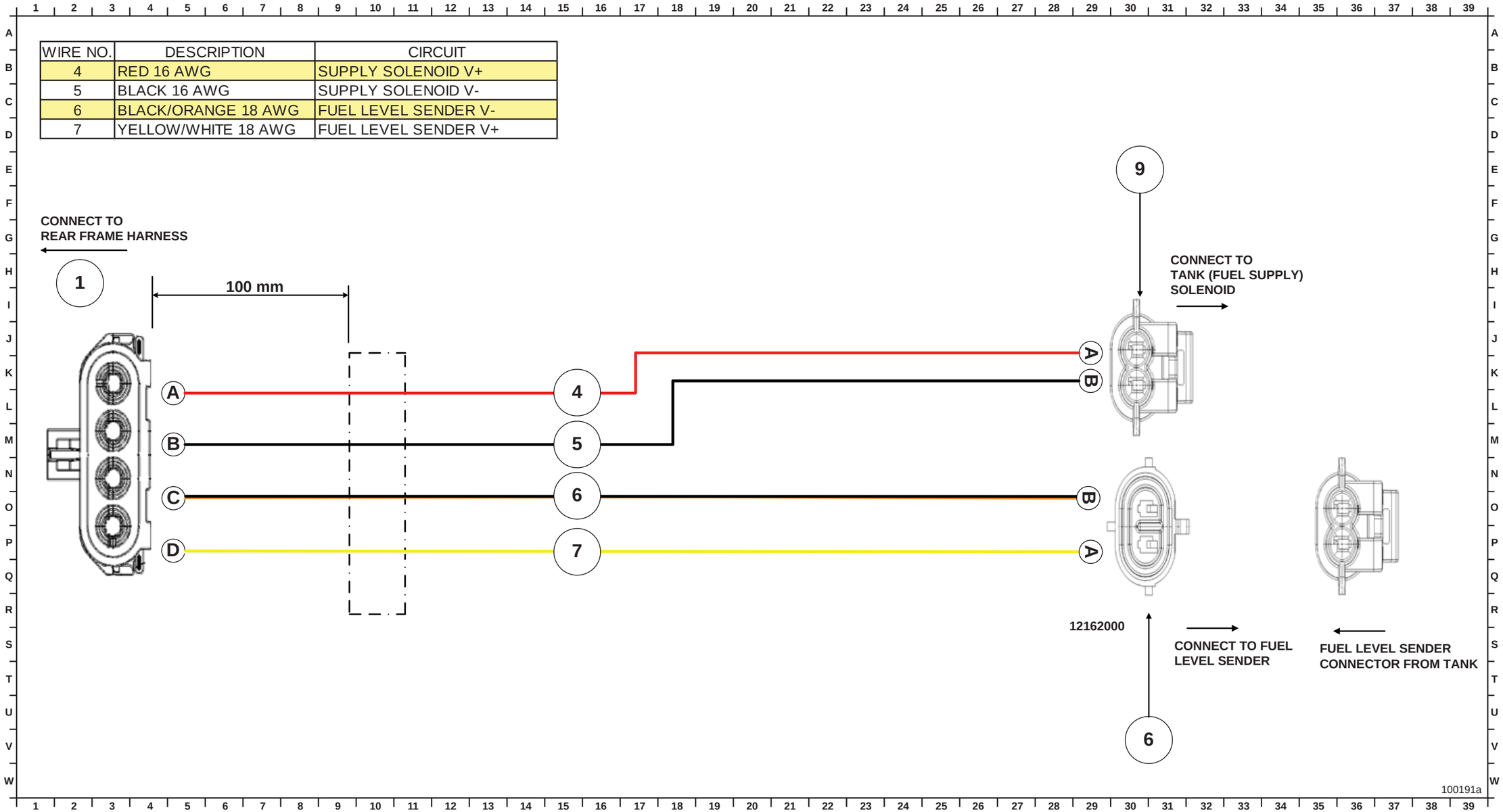


F-250/350 Pickup, Rear Frame Harness Electrical Schematic

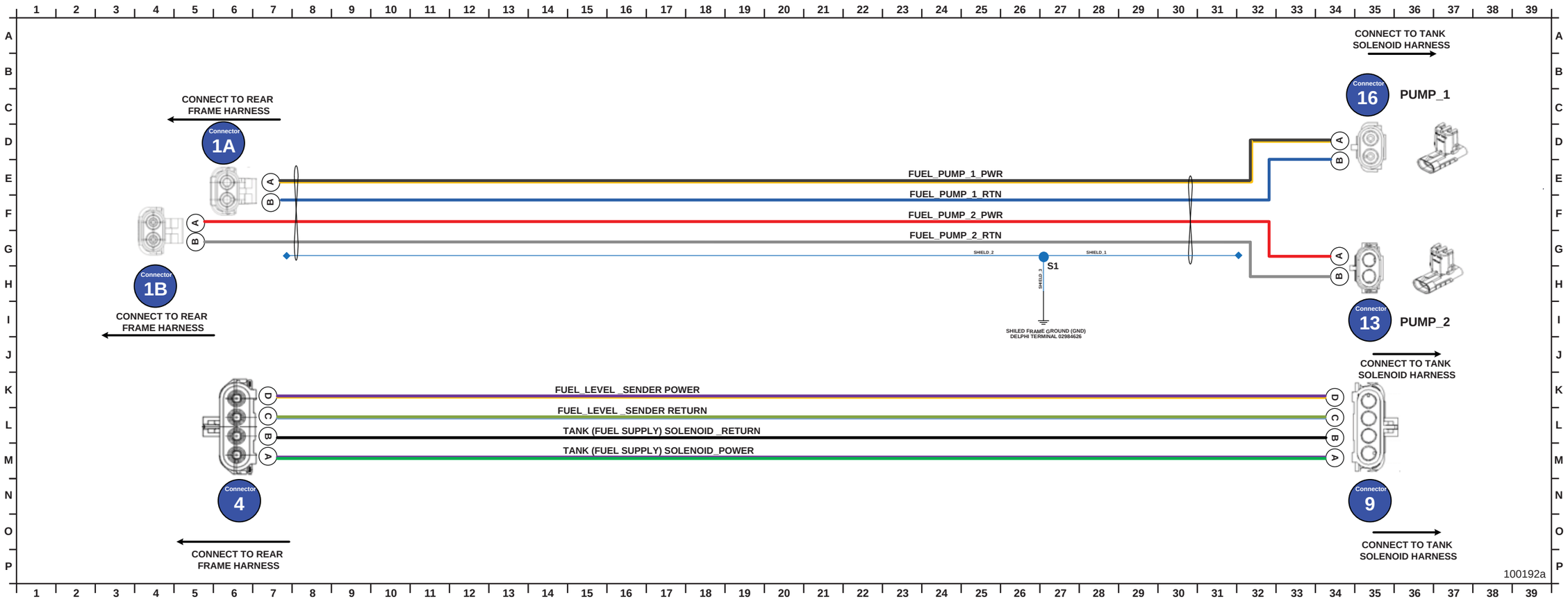


F-250/350 Pickup, Tank Solenoid Harness Electrical Schematic

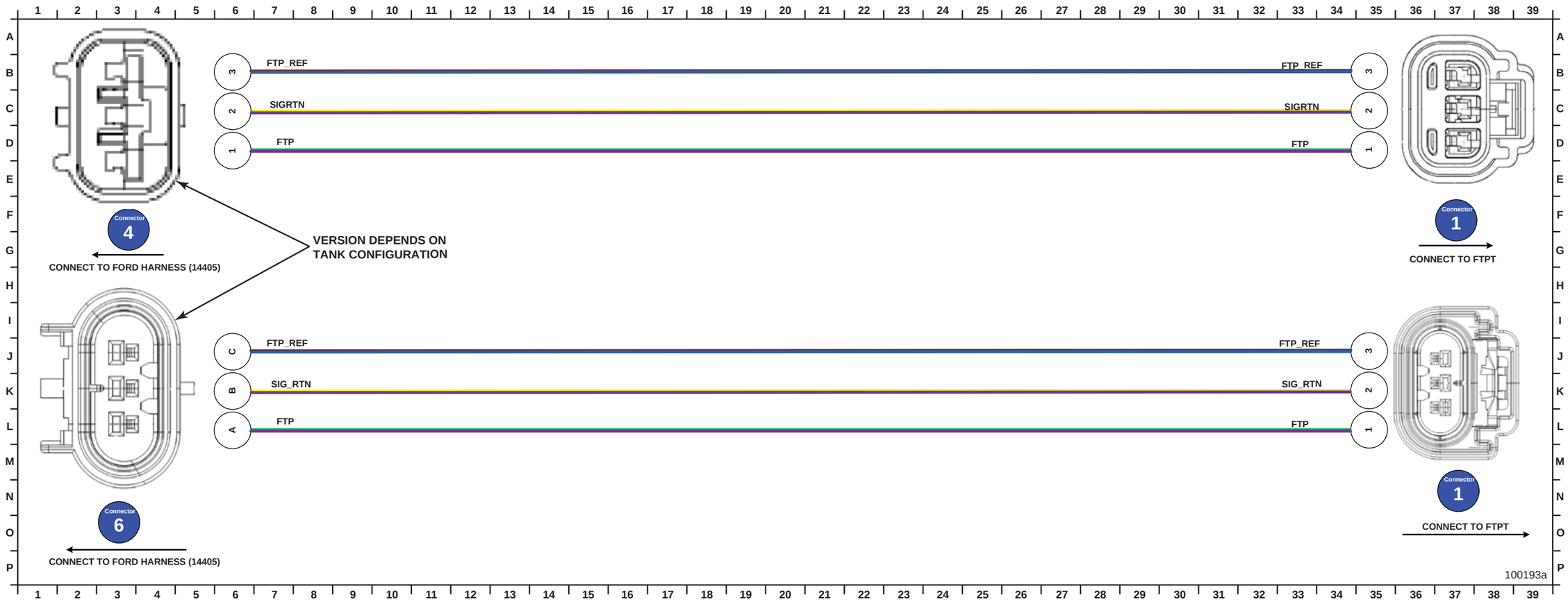
WIRE NO.	DESCRIPTION	CIRCUIT
4	RED 16 AWG	SUPPLY SOLENOID V+
5	BLACK 16 AWG	SUPPLY SOLENOID V-
6	BLACK/ORANGE 18 AWG	FUEL LEVEL SENDER V-
7	YELLOW/WHITE 18 AWG	FUEL LEVEL SENDER V+



F-250/350 Pickup, In-Bed Fuel Tank Jumper Harness Electrical Schematic



F-250/350 Pickup, FTPT Jumper Harness Electrical Schematic



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